NATIONAL TALENT SEARCH EXAMINATION

(NTSE-2021) STAGE-2

STATE: ALL **PAPER: MAT**

Date: 14.02.2021 **Time allowed: 120 mins** **Max. Mark: 100**

Question 1. If MENTAL = 390, ABILITY = 546, REASONING = 918, then COMPETENCY = ?

a. 782

b. 842

c. 1190

d. 1340

Answer: (c)

Solution:

MENTAL = 390

13+5+14+20+1+12= 65 (Sum of alphabets codes)

6   (Number of alphabets)

$\Rightarrow$ 6 × 65 = 390

ABILITY = 546

1+2+9+12+9+20+25 = 78 (Sum of alphabets codes)

7   (Number of alphabets)

$\Rightarrow$ 7×78 = 546

COMPETENCY = ?

3+15+13+16+5+20+5+14+3+25 = 119 (Sum of Alphabets codes)

10   (Number of Alphabets)

$\Rightarrow 119 \times 10 = \mathbf{1190}$

Question 2. Which number replaces the question mark in the given figure?

2	1
4	21

8	3
5	98

6	?
3	94

a. 4

b. 5

c. 7

d. 9

Answer: (c)

Solution:

2	1
4	21

8	3
5	98

6	**7**
3	94

$1^2+2^2+4^2 = 21$

$21 = 21$

$3^2+5^2+8^2 = 98$

$98 = 98$

$K^2+3^2+6^2 = 94$

$K^2 = 94-45$

$K^2 = 49$

$K = \mathbf{7}$

Direction: (Question 3 – 4)

The following questions are based on the information given below:

- **A cuboid shaped wooden block has 4 inches length, 3 inches breadth and 6 inches height.**
- **Two faces measuring 6 inches × 4 inches are coloured in black.**
- **Two faces measuring 4 inches × 3 inches are coloured in red.**
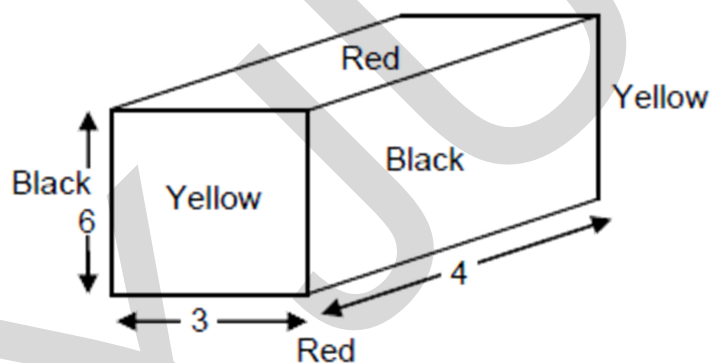- **Two faces measuring 6 inches × 3 inches are coloured in yellow.**

● **Now the block is divided into small cubes of side 1 inch each.**

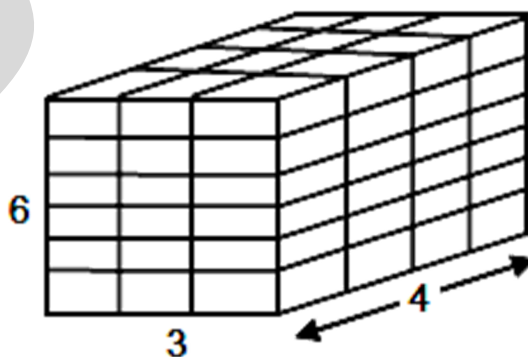**Question 3. How many small cubes will have no faces coloured?**

a. 8

b. 12

c. 36

d. 18

Answer: (a)

Solution:

After dividing into small cubes of 1

8 cubes.

Question 4. How many small cubes will have at least two faces coloured, one with red and another with yellow?

a. 4

b. 8

c. 12

d. 24

Answer: (c)

Solution:

At Least two faces coloured one with red and another with yellow = **12**

Question 5. In a certain code 34 means 'project work'. What is the meaning of 4 and 3 in that code?

Based on the following statements, select the correct option:

Statement I : '173' means 'completed project on time'.

Statement II : '640' means 'received award for the hard work'.

a. The data in statement I alone are sufficient to answer the question

b. The data in statement II alone are sufficient to answer the question

c. The data in both the statements together are sufficient to answer the question

d. The data even in both the statements together are not sufficient answer the question

Answer: (a, b)

Solution:

Given Coding

3→ Project

4 → Work

34 → Project work

173 → Completed project on time

640 → Received award for hard work

Hence, any one statement from I and II alone are sufficient to answer the question

Question 6.

Fact 1: All tortoises like to jump.

Fact 2: Some tortoises like to fly.

Fact 3: Some tortoises look like their followers.

If the first there statements are facts, which of the following statements must also be a fact?

I. All tortoises who like to fly look like their followers.

II. Tortoises who like to fly also like to jump.

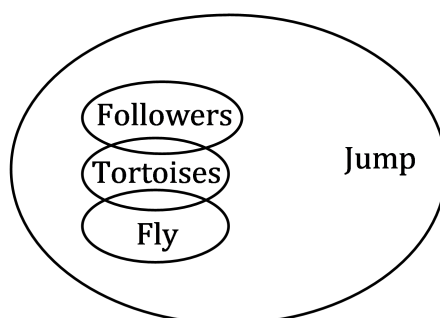**III. Tortoises who like to jump do not look like their followers.**

a. I only
b. II only
c. I and III only
d. II and III only

Answer: (b)

Solution:

(i) Not true for all

(ii) True for all

(iii) Not true for all

Question 7. At what time between 3 PM and 4 PM the angle between the minute and hour hands be nine degrees, the minute hand being ahead of the hour hand?

a. 3 h 15 m 45 s

b. 3 h 16 m

c. 3 h 16 m 30 s

d. 3 h 18 m

Answer: (d)
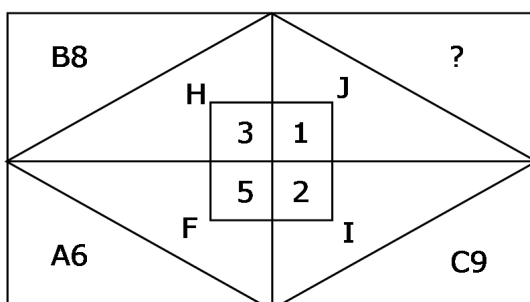
Solution:

3 PM to 4 PM

$\frac{11}{2}M - 30H = 9$

$\Rightarrow \frac{11}{2}M - 30 \times 3 = 9$

$\Rightarrow \frac{11}{2}M = 9 + 90$

$M = 99 \times \frac{2}{11} = 18$
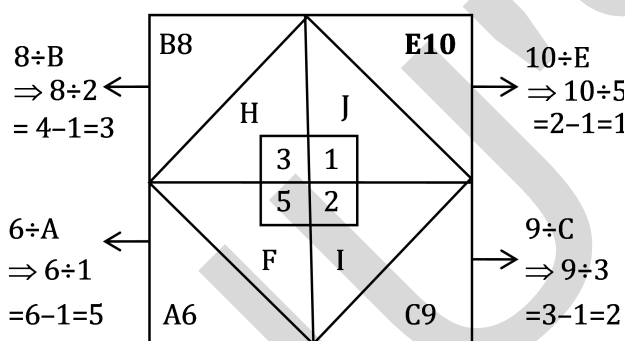
$\Rightarrow$ **3 h 18 minute**

Question 8. Which expression will replace the question mark?

a. E 7

b. D 10

c. D 7

d. E 10

Answer: (d)

Solution:

Question 9. The digits/numbers from 1 to 12 of the clock dial are replaced by the letters of the English alphabet. The replacement starts with letter 'C' but vowels and immediate next consonants of vowel are not included in the replacement. The classes in the school start at N : T and last till a time when the minute hand is at K and the hour hand between S and T, very slightly ahead of S. Five periods of equal duration are held during this interval. The break of 7 minutes is given to students after 1st period and duration of break increases by 2 minutes after each period. The exact duration of a period in minutes is:

a. 32

b. 33

c. 34

d. 35

Answer: (b)

Solution:

Watch
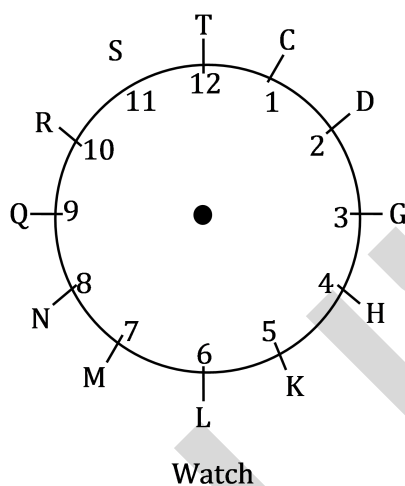
N : T = 8.00 AM to 11.25 AM

= 3Hours 25 Minutes.

= 180 + 25 = 205 Minutes

Total Break time = 7+9+11+13 = 40 Min.
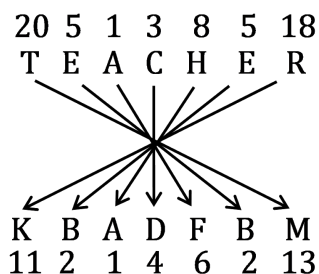
So, 205 − 40 = 165

Duration of period in min. $\frac{165}{5}$ = **33** Minutes

Question 10. In TEACHER is coded as KBADFBM, MATURE is coded as ALONEG, then the code of BOARD will be _____.

a. AMDJC

b. MADKC

c. MACKD

d. AMCJD

Answer: (a)

Solution:
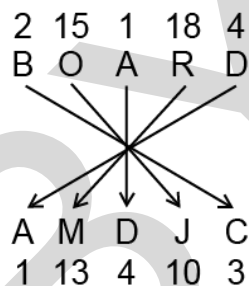
```
20 5 1 3 8 5 18
 T  E A C H E  R
```

Sum or difference of place values should be 7.

```
 K  B A D F B  M
11 2  1 4 6 2 13
```

Sum or difference of place values should be 7.

```
13  1 20 21 18  5
 M  A  T  U  R  E
```

Sum or difference of place values should be 6.

```
 A  L  O  N  E G
 1 12 15 14  5 7
```

Sum or difference of place values should be 6.

```
2 15 1 18  4
B  O  A  R  D
```

Sum or difference of place values should be 5.

```
 A  M D  J C
 1 13 4 10 3
```
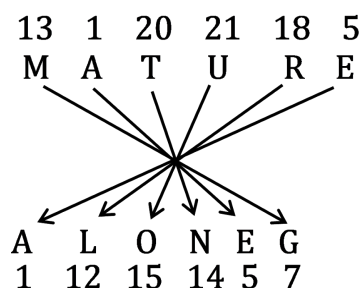
Sum or difference of place values should be 5.

Question 11. In a performing Arts competition, there are six participants M, P, B, K, L and V. It is given that M and P are good at dancing and acting. B and K are good at tabla but not good at singing. P and V are good at playing guitar an also good at singing. Who among them is/are good at dancing, singing, playing Guitar and acting?

a. M and P

b. Only P

c. Only V

d. Only B

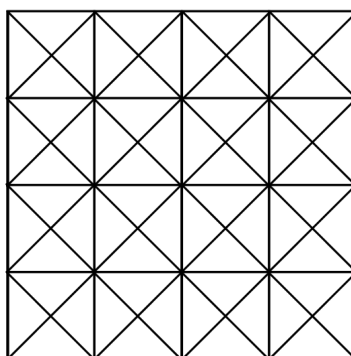Answer: (b)

Solution:

Dancing - M,Ⓟ
Singing - Ⓟ, V
Tabla - B, K
Guitar - Ⓟ, V
Acting - M, Ⓟ

Only P is there common in all

Question 12. What is the total number of squares in the given figure?

a. 62

b. 72
c. 82
d. 92

Answer: (b)

Solution: **72** Squares.

Question 13. In a certain coding system if
25 + 10 × 4 = 19
10 ÷ 3 − 3 = 10
Then the value of
16 × 5 + 40 − 10 ÷ 2 =

a. 10
b. 11
c. 12
d. 13

Answer: (d)

Solution

$$25 + 10 \times 4 = 19$$
$$25 - 10 + 4 = 19$$

$$10 \div 3 - 3 = 10$$
$$10 \times 3 \div 3 = 10$$

i.e. is replacing

$$
\begin{array}{ccc}
+ & \longrightarrow & - \\
\times & \longrightarrow & + \\
\div & \longrightarrow & \times \\
- & \longrightarrow & \div
\end{array}
$$

So, the 16 × 5 + 40 – 10 ÷ 2 = ?

16 + 5 – 40 ÷ 10 × 2

= 21 – 4 × 2 = **13**

Therefore, option (d) is correct.

Question 14. In the given sequence, which symbol comes five symbols before the symbol which comes nine symbols after the second appearance of the symbol which occur four times in the sequence?

1 >9 ∈ < L * M 2 N > Q A ÷ S 8 > 4 U $ V @ A > X 2 Q B = D < Z
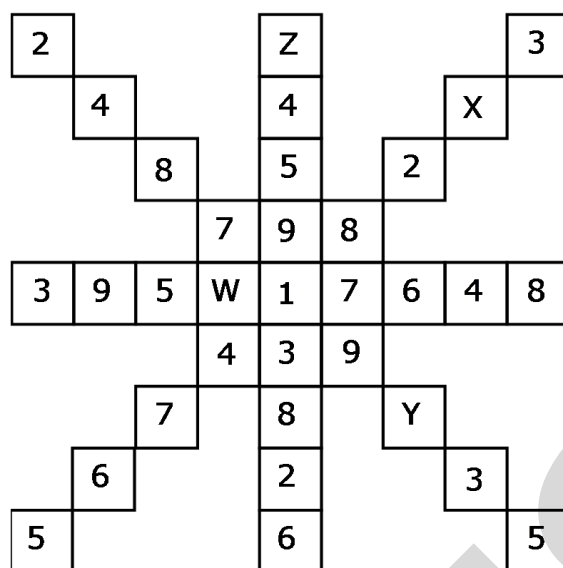
a. A

b. S

c. @

d. 8

Answer: (b)

Solution:

Four time occurring → >

Nine symbol after second appearance of > → $

Five symbol before $ → **S**

Question 15. Find the values of W, X, Y and Z in the given figure.

	2				Z				3
		4			4			X	
			8		5		2		
			7	9	8				
3	9	5	W	1	7	6	4	8	
			4	3	9				
		7		8		Y			
	6			2			3		
5				6				5	

a. 2, 9, 6, 7

b. 3, 5, 1, 5

c. 4, 1, 8, 7

d. 8, 1, 2, 5

Answer: (a)

Solution:

Sum of numbers vertically, horizontally and diagonally is equal and by observation we
 see it is 45.

W + 43 = 45   X + 36 = 45,   39 + Y = 45,   Z + 38 = 45

W = 2,   **X = 9,**   **Y = 6,**   **Z = 7**

Direction: (Question 16-17)

In the following questions, the symbols @, $, #, © and % are used with the following meanings as illustrated below:

P $ Q means 'P' is not smaller than Q.

P © Q means 'P' is neither greater nor equal to Q.

P # Q means 'P' is neither smaller nor equal to Q.

P % Q means 'P' is not greater than Q.

P @ Q means 'P' is neither greater not smaller than Q.

Assuming the given statements to be true, find which of the conclusing given below is definitely true?

Question 16. Statement: T % R, R \$ M, M @ D, D © H

Conclusion:

I. D % R   **II. H # R**   **III. T © M**   **IV. T % D**

a. Only I

b. I and III

c. I and IV

d. III and IV

Answer: (a)

Solution:

T≤ R → T ≤ R

R ≤ M → R ≥ M

M @D → M = D

D © H → D < H

i.e. T ≤ R, M = D ≤ R, M = D < H

(i) **D % R → D ≤ R**

(ii) H # R → H > R

(iii)T ©M → T < D

(iv)T % D → T ≤ D

Only D % R → D ≤ R satisfies

Question 17. Statement: M @ B, B # N, N $ R, R © K

Conclusions:

I. K © R   **II. R © B**   **III. M $ R**   **IV. N © M**

a. I and III

b. I, II and III

c. II, III and IV

d. I, III and IV

Answer: (c)

Solution:

M @ B → M = B

B # N → B > N

N $ R → N ≥ R

R © K → R < K

i.e M = B > N ≥ R and K > R

(i) K © R → K < R

(ii) R © B → R < B

(iii) M $ R → M ≥ B

(iv) N ©M → N < M

 (ii),(iii) and (iv) are correct

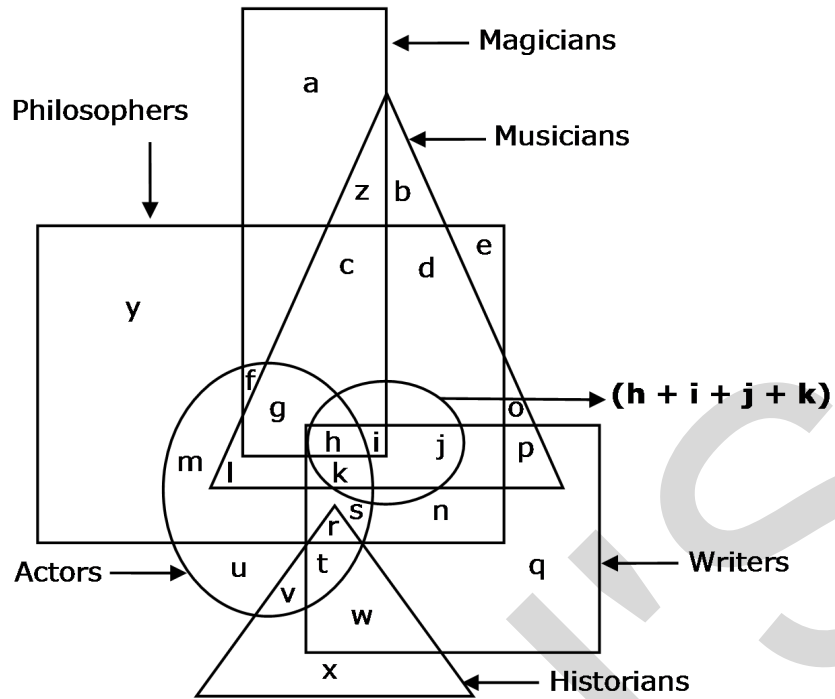**Direction : (Question 18-20)**
Study the diagram and answer the question.
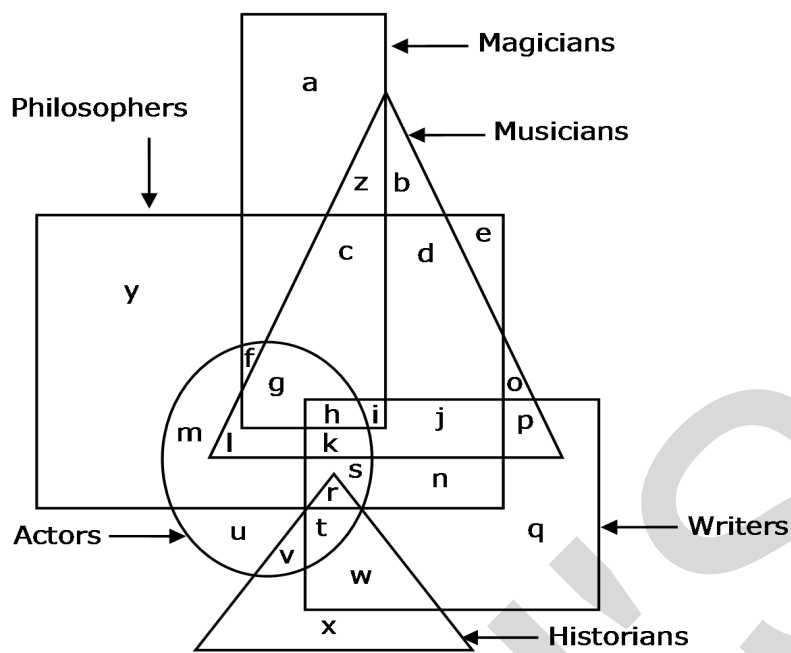
Question 18. Identify the region which represents philosophers who are musicians and writers.

a. h + i + j + k
b. h + i
c. k + j
d. j

Answer: (a)

Solution:

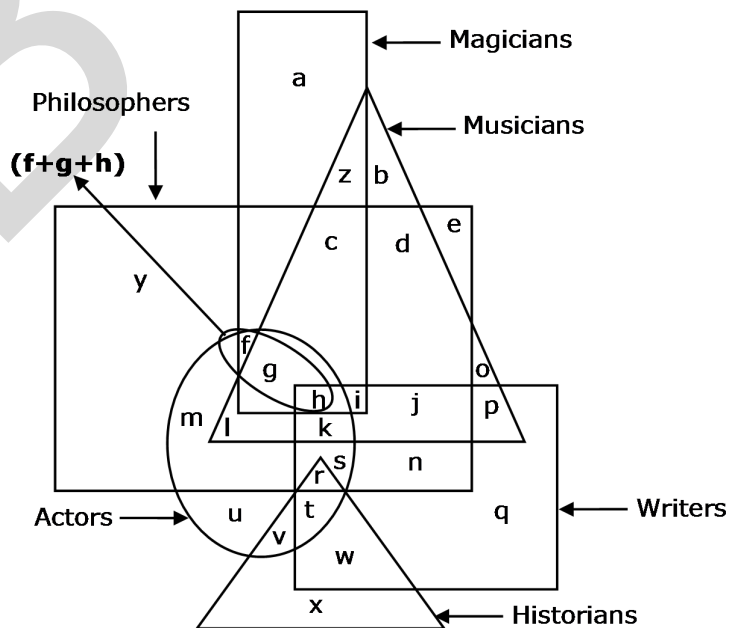## Question 19. How many actors are magicians?
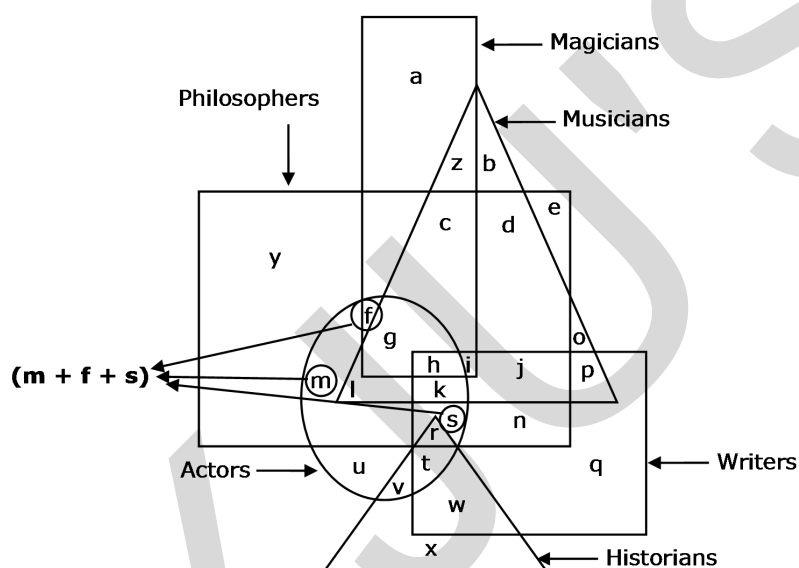
a. g
b. g + h
c. f +g + h
d. f + g − h

Answer: (c)

Solution:

Question 20. How many actors are also philosophers but not historians or musicians?

a. l + k
b. g + h + k
c. m + f + l + k
d. m + f + s

Answer: (d)

Solution:

Question 21. Bhupen's birthday is on the 13th of June and Mainu's birthday is on 23rd of April. If in a particular year, Mainu's birthday was on Monday, what will be the day on Bhupen's birthday in the same year?

a. Tuesday
b. Wednesday
c. Thursday
d. Friday

Answer: (b)

Solution:
Mainu's Birthday → 23rd April Monday
Bhupen's Birthday → 13th June
Odd days from April 23th to 13th June
April + May + June
7+31+13 = 51 days

$\Rightarrow \dfrac{51}{7}$ = 7 week = 2 odd days.

So Bhupen's birthday is on Monday +2 = **Wednesday**.

Direction: (Question 22-24)

Study the following information and answer the question below:

Dr. Ashutosh is available at a clinic from 12 Noon to 4 PM on Tuesday, Thursday and Sunday.

Dr. Dhanwantri is available at the same clinic from 10 AM to 2 PM on Monday, Thursday, Friday and Sunday.

Dr. Shehnaz is available at the same clinic between 9 Am to 12:30 PM on Monday, Wednesday and Thursday and 2 PM to 4 PM on Friday, Saturday and Sunday.

Question 22. At what time duration of a week are all the doctors available at the clinic ?

a. Sunday for 3 hrs.

b. Thursday for $\dfrac{1}{2}$hr.

c. Thursday for 1 hr.

d. Sunday for 1 hr.

Answer: (b)

Solution:

All doctor's time schedule.

Dr. Ashutosh $\rightarrow$ 12 $-$ 4 PM (Tuesday, Thursday and Sunday)

Dr. Dhan wantri $\rightarrow$ 10AM $-$ 2PM (Monday, Thursday, Friday. Sunday)

Dr. Shehnaz $\rightarrow$ 9AM $-$ 12:30 PM (Monday, Wednesday and Thursday)

2PM $-$ 4PM (Friday, Saturday, Sunday)

Thursday is common all doctors and all doctors available at the clinic time is

= **Thursday** 12:00 to 12:30 = $\dfrac{1}{2}$ **hr**

Question 23. On how many days and hours, Dr. Ashutosh and Dr. Shehnaz are available at the same time ?

a. 1, $2\frac{1}{2}$

b. 1, 2

c. 2, $2\frac{1}{2}$

d. 2, 2

Answer: (c)

Solution:

Dr. Ashutosh & Dr. Shehnaz are available on Sunday & Thursday.

Sunday → 2PM – 4PM → 2 hour

Thursday → 12PM to 12.30PM → $\frac{1}{2}$ hour

Therefore **2 day. $22\frac{1}{2}$**hour.

Question 24. For how many hours in a week, Dr. Dhanwantri and Dr. Shehnaz are together available at the same time ?

a. $5\frac{1}{2}$

b. 6

c. 5

d. $2\frac{1}{2}$

Answer: (c)

Solution:

Dr. Dhanwantri & Dr. Shehnaz are available same day and time.

⇒ Thursday and Monday.

Per day 10 AM to 12.30 PM = $2\frac{1}{2}$ hour

2 day = **5** hour

Question 25. In a certain school, 62% of candidates qualified all the three subjects, namely English, Mathematics and Social Science. The following diagram gives the number of candidates who are not qualified in different subjects. What is the percentage of candidates who are not qualified in at least two subjects ?
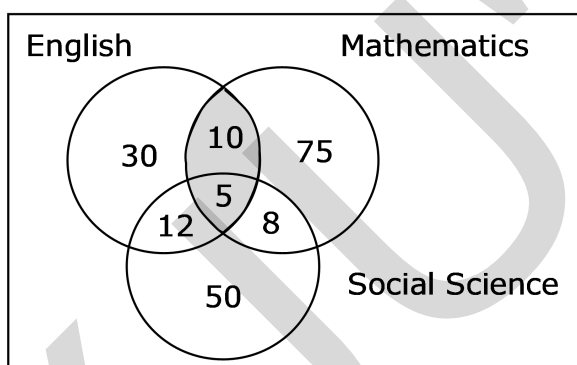
a. 2.63

b. 6.00

c. 7.00

d. 18.42

Answer: (c)

Solution:

Let total students = A

62% qualified and 38% not qualified

38% of A = 30+12+50+10+5+8+75 = 190

$\frac{38}{100}$ × A = 190

$A = \frac{190 \times 100}{38} = 500$

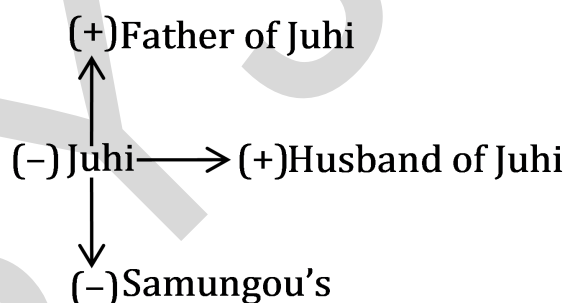At Least two = (12+10+8+5) = 35 (not qualified)

$= \frac{35}{500} \times 100 = $ **7**

Question 26. Samungou's mother is the only daughter of Juhi's father. How is Juhi's husband related to Samungou ?

a. Brother

b. Father

c. Son

d. Uncle

Answer: (b)

Solution:

$$(+)\text{Father of Juhi}$$
$$\uparrow$$
$$(-)\text{Juhi} \longrightarrow (+)\text{Husband of Juhi}$$
$$\downarrow$$
$$(-)\text{Samungou's}$$

Juhi is the only daughter so she is samungou's mother.
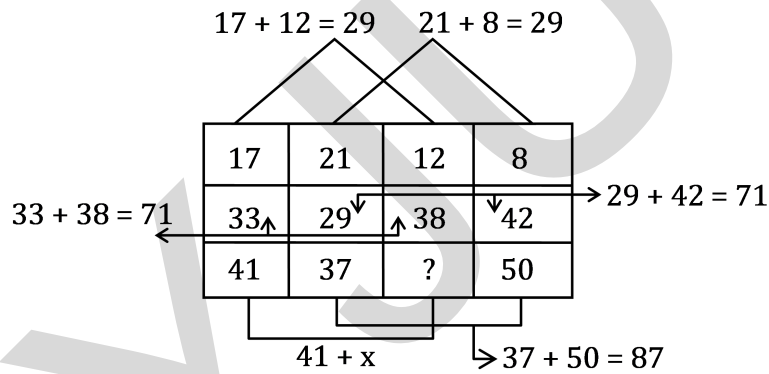
Juhi's husband is Samungou's **father**.

Question 27. A matrix of certain characters is given in the following. These characters follow a certain trend, row-wise or column wise. Find out this pattern and choose the missing character.

17	21	12	8
33	29	38	42
41	37	?	50

a. 12

b. 42

c. 46

d. 50

Answer: (c)

Solution:

$$17 + 12 = 29 \quad 21 + 8 = 29$$

17	21	12	8
33	29	38	42
41	37	?	50

$33 + 38 = 71$ $29 + 42 = 71$

$41 + x$ $37 + 50 = 87$
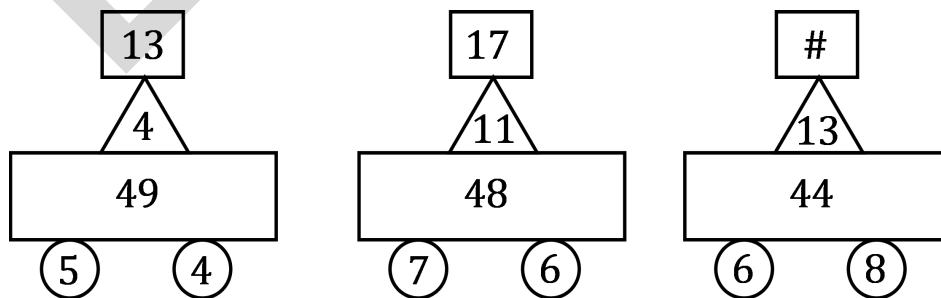
X = 87−41 = **46**

Question 28. Find the value of # in the figure below :

a. 10

b. 15

c. 19

d. 21

Answer: (c)

Solution:
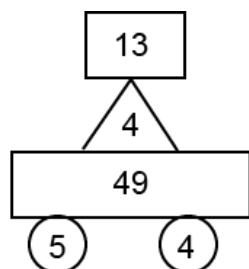
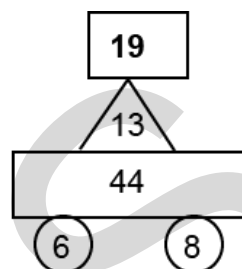$(13-4) \times 5 + 4 = 49$ $(17-11) \times 7 + 6 = 48$ $(x-13) \times 6 + 8 = 44$

$9 \times 5 + 4 = 49$ $6 \times 7 + 6 = 48$ $6x - 78 + 8 = 44$
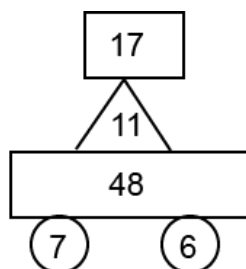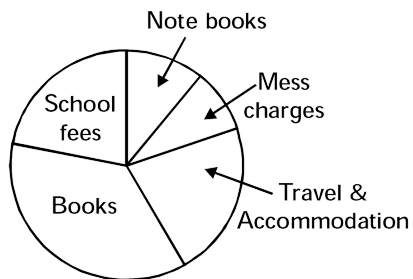
$49 = 49$ $48 = 48$ $x = \dfrac{114}{6} = 19$
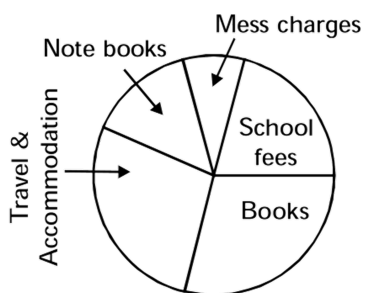
Direction : (Question 29)

The yearly percentage expenditure of a school student on various items is shown in table given below:

Question 29. Which of the following figures represent the above data ?

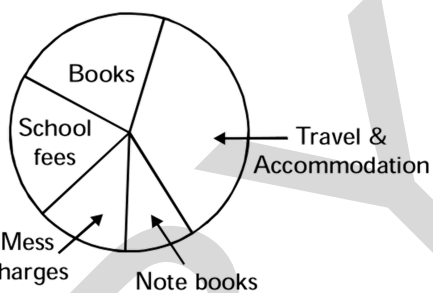| Items	Expenditure
Books	30
Note Books	10
School fee	20
Mess Charges	5
Travel & Accommodation	35

a.

b.

c.

d.
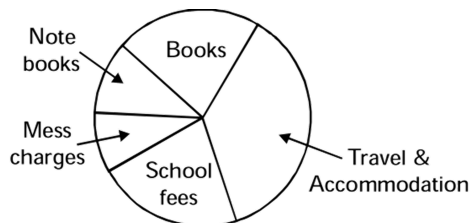
Answer (b)

Solution:

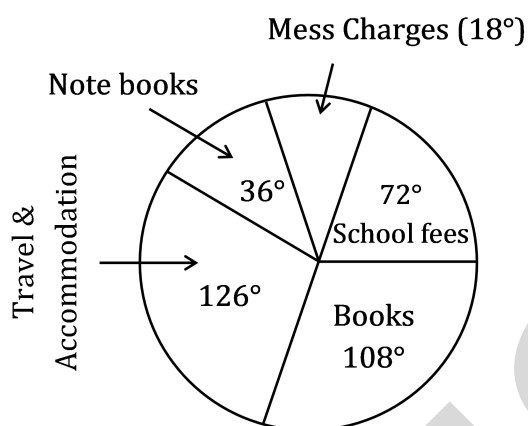Total angle of the circle is 360°.

So according to given data calculated

Book = $\frac{30}{100}$ × 360° = 108°

Notebook = $\frac{10}{100}$ × 360° = 36°

Mess charge = $\frac{5}{100}$ × 360° = 18°

School fee = $\frac{20}{100} \times 360° = 72°$

Travel and accommodation = $\frac{35}{100} \times 360° = 126°$

Question 30. In an examination students are graded with four grades namely A, B, C and D and 72 students of the school secured A grade. The ratio of students who secured A grade to students with D grade is 2 : 5. Out of the total students 30% students secured B grade and 40% secured C grade. What is the total number of students in the school?

a. 840
b. 600
c. 420
d. 360

Answer: (a)

Solution:

Student secured A grad = 72

Ratio = $\frac{2}{5} = \frac{36}{180}$

So, students with D grade = 5 × 36 = 180

A and D grade student = 72 + 180 = 252

30% of total = 252

Total Number of students in school = $\frac{252}{30} \times 100$

= **840**

Question 31. Given below are three statements followed by four alternatives. Select the alternative which follows logically, from the given statements.

I. Only boys can register for a competition.

II. Many of the competitors are toppers.

III. All the names of toppers are marked with green colour.

a. All toppers are competitors.

b. Some of the competitors are boys

c. Some of the competitors are marked with green colour.

d. Only the names of boys are marked with green colour.

Answer: (c)

Solution:
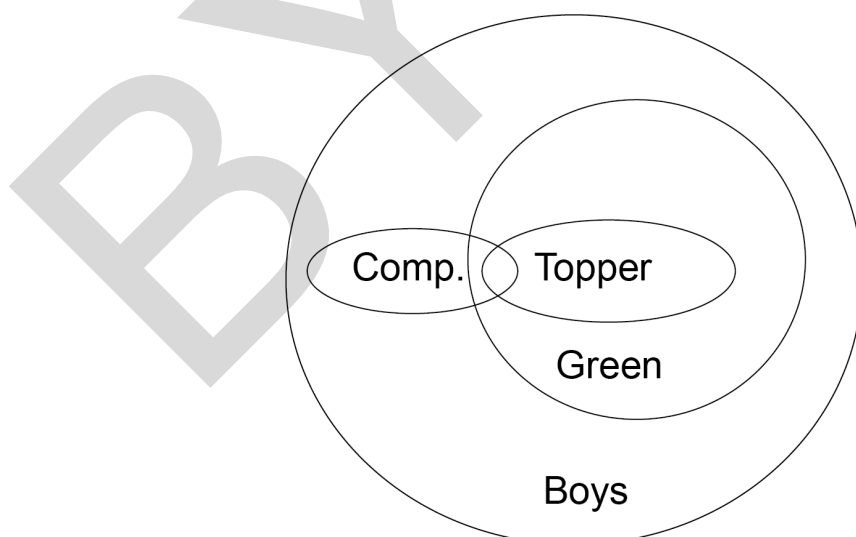
Question 32. Find the missing number in the given sequence. 1, 2, 2, 4, _____ 4, 2.

a. 1

b. 2

c. 3

d. 4

Answer: Bonus

Solution: No pattern can be deduced.

Question 33. Which figure among the given options will appropriately replace the question mark?

a.

b.

c.

d.
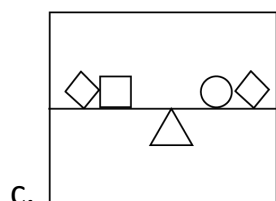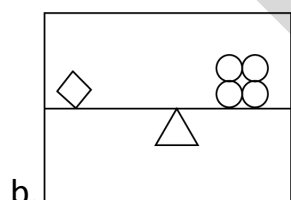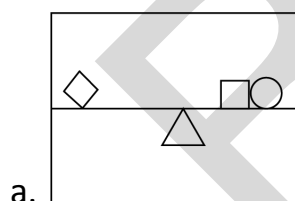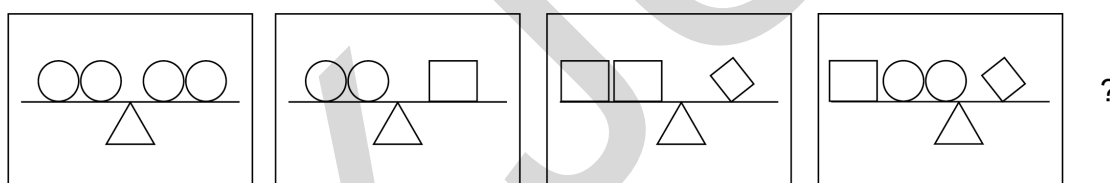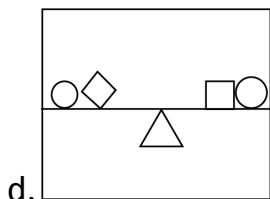
Answer: (b)

Solution:

$$\text{Let } O = x$$
$$\square = y$$
$$\diamondsuit = z$$

By observation

$2x = y$

$2y = z$

$2x + y = z$

So, $4x = z$

Therefore, option (b) is correct.

Question 34. Given below are 9 pictures, A, B, C, D, E, F, H and I. On the basis of similar relationship, classify the pictures into three groups. Which among the given options represents the suitable group combination?
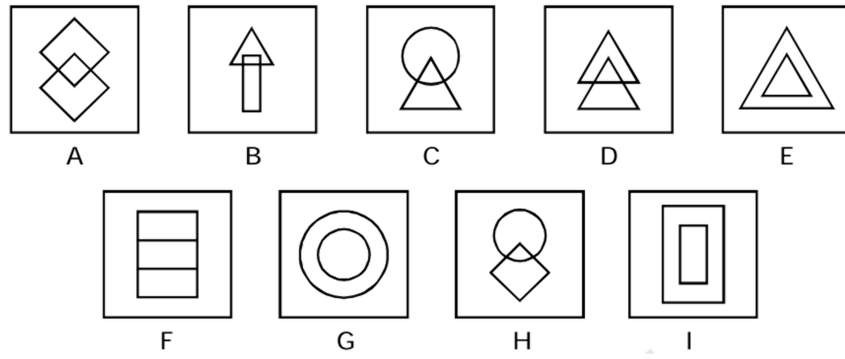
a. (A, D, F); (B, C, H); (E, G, I)

b. (A, D, H); (B, C, F); (E, G, I)

c. (A, D, F); (B, C, H); (E, G, I)

d. (B, C, H); (D, E, F); (A, G, I)

Answer: (a) and (c)

Solution:

a. Options (A, D, F); (B, C, H); (E, G, I)

Options (A, D, F) are equal sequence
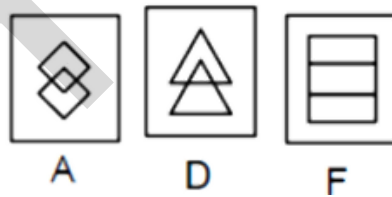
(B, C, H) are equal sequence
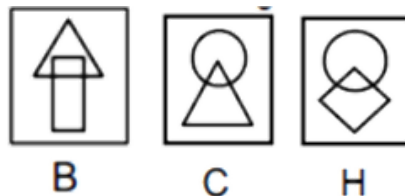
(E, G, I) are equal sequence
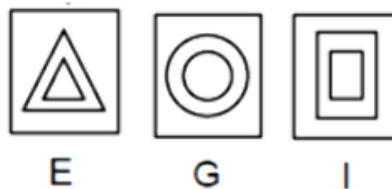
Therefore, option (a, c) is correct.

Question 35. If − means ÷, _+ means ×, ÷ means −, × means +, then which of the following is correct?
(A) 36 − 12 × 6 ÷ 3 + 4 = 60
(B) 52 ÷ 4 + 5 × 15 − 3 = 37
(C) 36 × 4 − 12 + 5 ÷ 3 = 420
(D) 43 × 7 + 5 + 4 − 8 = 25

a. A
b. B
c. C
d. D

Answer: (b)

Solution:

$- \rightarrow \div$

$+ \rightarrow \times$

$\div \rightarrow -$

$\times \rightarrow +$

So 52 ÷ 4 + 5 × 15 − 3 = 37 replacing according question

$\Rightarrow 52 - 4 \times 5 + 15 \div 3 = 37$

$\Rightarrow 52 - 20 + 5 = 37$

$\Rightarrow 37 = 37$

Therefore, option (b) is correct.

Question 36. The following figure represents numbers of students in each of the clubs in a school.
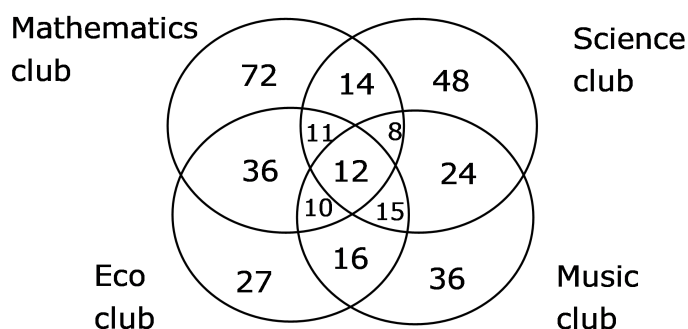
Find the number of students representing at least two clubs of the school.

a. 90

b. 134

c. 146

d. 183

Answer: (c)

Solution:
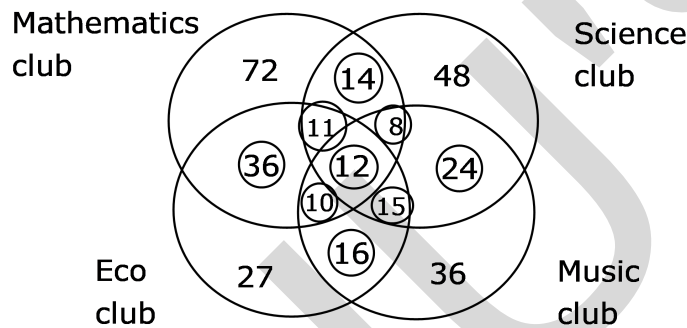
Diagram showing all the bubbles showing the number of students at least of two clubs.

16 + 10 + 15 + 12 +24 + 36 + 11 + 8 + 14 = **146**

Therefore, option (c) is correct.

Question 37. The ratio of boys and girls in a school for the last five academic years are given in the following graph. If the number of girls in 2016-17 is half of that in 2017-18, what is the ratio of boys in 2017-18 to boys in 2016-17?
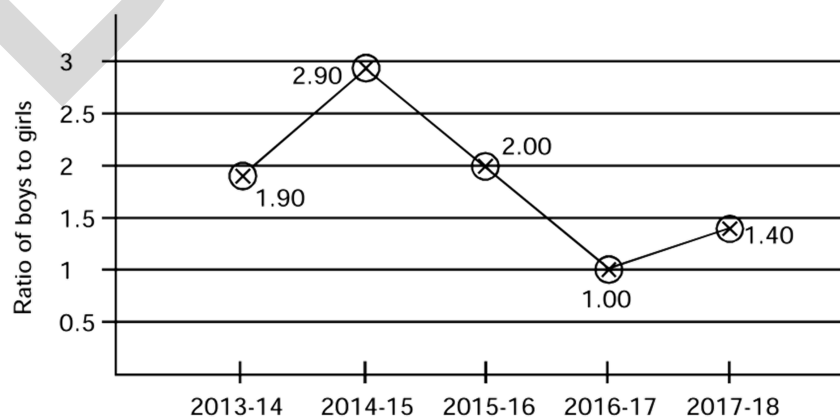
a. 1 : 1

b. 3 : 2

c. 14 : 5

d. 7 : 3

Answer: (c)

Solution:

Let B_1 & G_1, represents the number of boys and girls represented in year 2016–2017.

And, B2 & G2 represent the number of boys and girls represented in year 2017–2018.

$$\frac{B_1}{G_1} = 1, \frac{B_2}{G_2} = 1.40, \frac{G_1}{G_2} = \frac{1}{2}$$

$$\Rightarrow \frac{B_2}{B_1} = \frac{1.4G_2}{G_1} = \frac{1.4\,G_2}{G_2/2} = \frac{2.8}{1} = \frac{28}{10} = \frac{14}{5}$$

Ratio = **14:5**

Therefore, option (c) is correct.

Question 38. A manufacturer of tennis balls is claimed that their balls are the best as it (a ball) would rise constantly 10% of the height from which it was dropped.
If the ball is dropped from 27 feet, how much approximately in feet the ball travels (in feet) before coming to rest?

a. 32.4

b. 33

c. 34.6

d. 36

Answer: (b)

Solution:

$$27 + 2 \times \frac{27}{10} + 2 \times \frac{27}{100} \ldots \infty$$

$$\Rightarrow \left[2 \times 27 + 2 \times \frac{27}{100} + \ldots \infty \right] - 27$$

$$\Rightarrow 2 \times 27 \left[1 + \frac{1}{10} + \frac{1}{100} \ldots \infty \right] - 27$$

$$\Rightarrow 54 \times \left(\frac{1}{1 - \frac{1}{10}} \right) - 27 \Rightarrow 60 - 27 = \mathbf{33}$$

Question 39. Find the values of X and Y.

	9			16			49	
64	2	15	100	2	24	x	Y	70
	25			36			100	
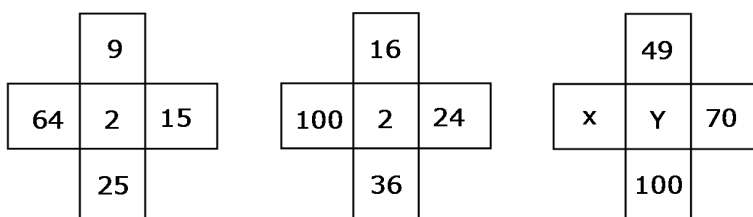
a. 289, 3

b. 289, 5

c. 121, 7

d. 121, 4

Answer: (a)

Solution:

	9	
64	2	15
	25	

$\sqrt{64} = 8$ $\sqrt{25} + \sqrt{9} = 8$

$\sqrt{9} = 3$ $\left(\sqrt{25} \times \sqrt{9}\right) = 15$

$\sqrt{25} = 5$ $\sqrt{25} - \sqrt{9} = 2$
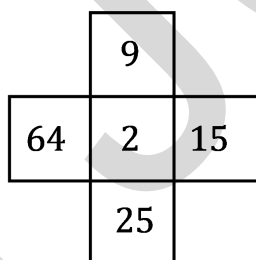
$\sqrt{x} = \sqrt{100} + \sqrt{49}$

x = **289**

y = $\sqrt{100} - \sqrt{49}$ = 10 − 7 = **3**

Question 40. Which is the missing term of the following sequence?
002 B, 009 I, 028 J, _____, 126 I

a. 048 L

b. 065 K

c. 172 G

d. 186 N

Answer: (b)

Solution:

For Numbers		For alphabets. Sum of Number
$1^3 + 1 = 002$	$\rightarrow$	B = 0 + 0 + 2 = 2
$2^3 + 1 = 009$	$\rightarrow$	I = 0 + 0 + 9 = 9
$3^3 + 1 = 028$	$\rightarrow$	J = 0 + 2 + 8 = 10
$4^3 + 1 = \mathbf{065}$	$\rightarrow$	K = 0 + 6 + 5 = 11
$5^3 + 1 = 126$	$\rightarrow$	I = 1 + 2 + 6 = 9

Question 41. How many triangles are there in the given figure ?
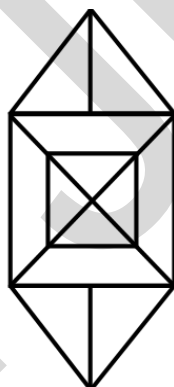
a. 21

b. 22

c. 23

d. 24

Answer: (b)

Solution:
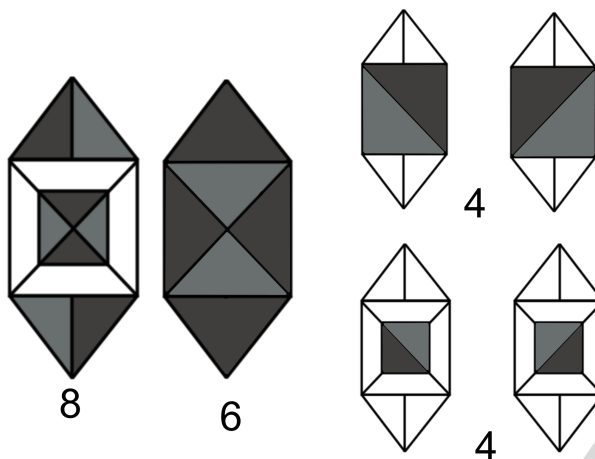
Total 22 triangle

Question 42. In a class of 60 students, where girls and boys are in the ratio 2 : 3, the boy 'Kartik' is ranked 17th from the top. If there are 9 girls ahead of Kartik, what is the ratio of number of girls and boys after the rank position of Kartik?

a. 9 : 27

b. 15 : 28

c. 16 : 27

d. 16 : 28

Answer: (b)

Solution:
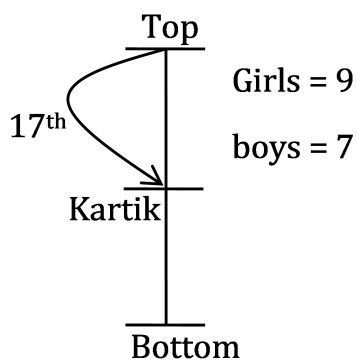
Total students 60

Girls = 24

Boys = 36

Rank of Kartik from top = 17

Ahead → 9 girls

        7 boys

Kartik (17)

After that there are

36 - 8 = 28 boys

24 - 9 =15 girls

Ratio of girls and boys ⇒ **15 : 28**

Question 43. Select the pair that has the same analogy as given pair 9876 : 12234567

a. 34562 : 89776

b. 1234 : 122345

c. 654321 : 922346

d. 9993 : 8886

Answer: (d)

Solution:

$$\underset{\substack{\text{All sum}\\30}}{\underbrace{9876}} : \underset{\substack{\text{All sum}\\30}}{\underbrace{12234567}}$$

Similarly,

$$\underset{\substack{\text{All sum}\\30}}{\underbrace{9993}} : \underset{\substack{\text{All sum}\\30}}{\underbrace{8886}}$$

Therefore, option (d) is correct.

Question 44. A square piece of paper is folded as shown, punched and unfloded. Which of the alternative figures resembles the unfolded paper?
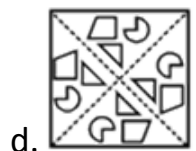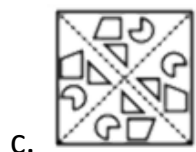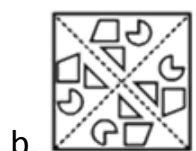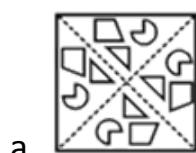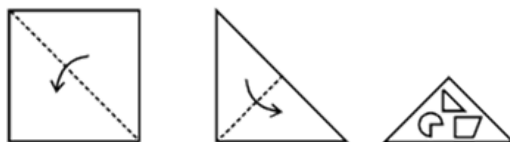
a.

b.

c.

d.

Answer: (d)

Solution: By observation

Question 45.

If $\triangle\ / = 5$
$/\ L\ \Delta = 7$
$/\ L\ \square\ \triangle = 15$
$\square\ \heartsuit = 24$

Then, 23 is given by

a. ∟ ☐ ⬠ /

b. ∟ △ ☐ ⬠

c. ☐ / △ ∟

d. ∟ △ / ⬠

Answer: (d)

Solution:

$$∟ = 2$$

$$☐ = 8$$

$$⬠ = 16$$

$$△/ = 5$$

$$∟ + △/ + ⬠ = 2 + 5 + 16 = 23$$

Therefore, option (d) is correct.

Question 46. Complete the following figural series by choosing the correct answer from the given alternatives.

a.

b.

c.

d.
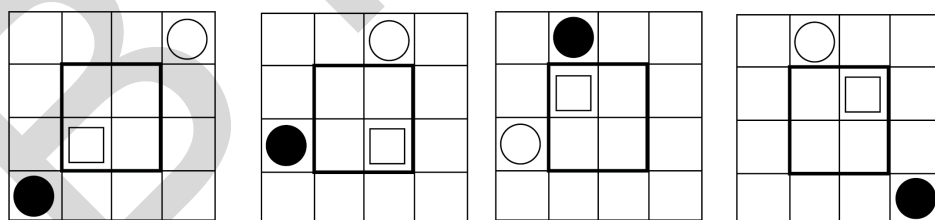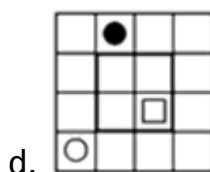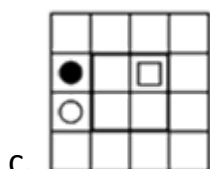
Answer (a)

Solution:
Inner square = +1, +2, +3, +4: anticlockwise
Black circle = +1, +3, +5, +7: clockwise
White circle = +1, +4, +9, +16: anticlockwise

Question 47. A problem figure is given below. When it is rotated, it fits into one of the option figures. Identify the option figure.

a.

b.

c.

d.

Answer (d)
Solution:

Rotate 180° clockwise
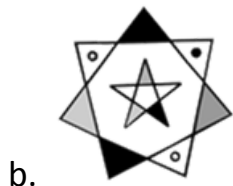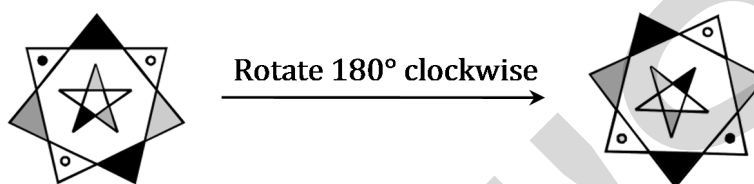
Question 48. The problem figure given below is a figure matrix. Complete the matrix with suitable option figure.

a.

b.

c.

d.
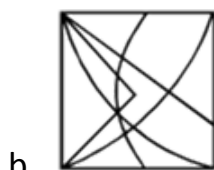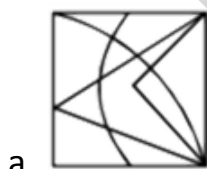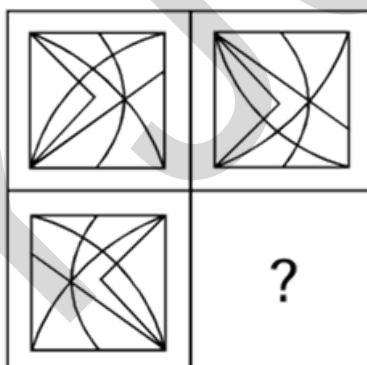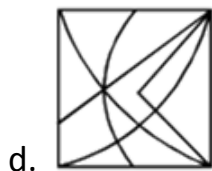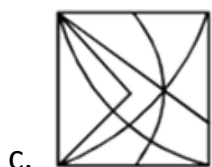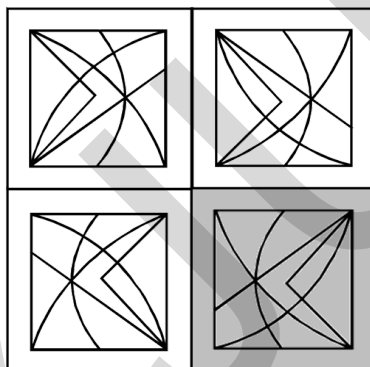
Answer (d)

Solution:

Question 49. Nine figures are given below. Identify the correct group of classification.
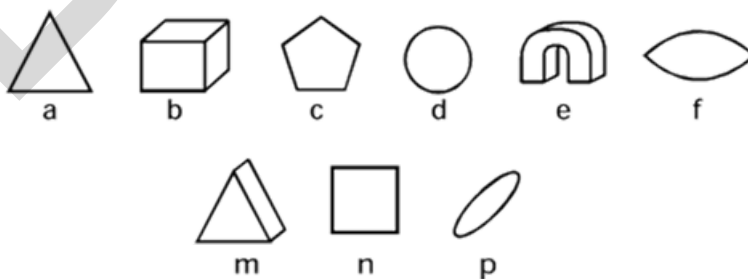
a. a, b, m; b, e, n; c, f, p

b. a, b, m; c, d, n; e, f, p

c. a, d, f; b, e, p; c, m, n

d. a, c, n; b, e, m; d, f, p

Answer: (d)

Solution:

a, c, n → plane figure (polygon)

b, e, m → Solid figure

d, f, p → Closed curve

Therefore, option (d) is correct.

Question 50. An identity is given below through some symbols. In the options these symbols are decoded. Identify the correct option of which the signs satisfy the given identity.

$$12.\text{O } 13\square \text{ } 15 \triangle 5 * 180 \wedge 21$$

a.
  ^ is −, * is =, △ is ÷, □is +, O is ×

b.
  O is −, ^ is =, * is +, △ is ÷, □ is ×

c.
  □is −, O is =, ^ is ×, * is +, △ is ÷

d.
  is÷, □ is =, O is −, ^ is +, * is ×

Answer: (a)

Solution:

12. O 13□ 15 Δ 5 * 180 ^ 21

$12 \times 13 + 15 \div 5 = 180 - 21$

$\Rightarrow 156 + 3 = 159$

$159 = \mathbf{159}$

Question 51. Complete the following figural series by choosing the correct answer from the given alternatives.

a.

b.

c.

d.
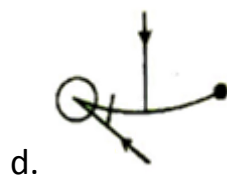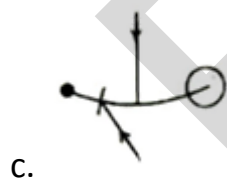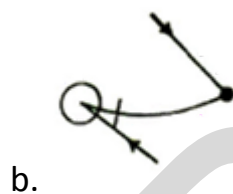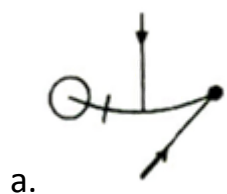
Answer: (d)

Solution: By observation

Question 52. A pentagonal figure is given below. Identify which two of the pieces among A, B, C, D and E given below will NOT be required to complete the pentagonal figure.
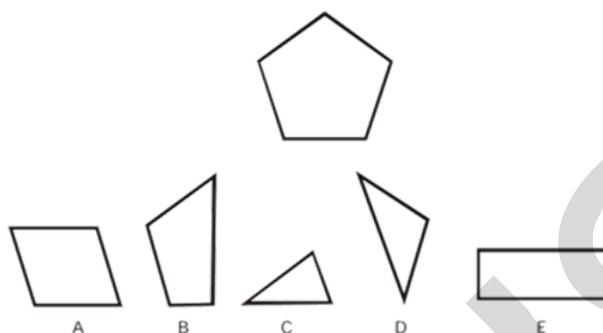
a. Both A and C

b. Both B and D

c. Both A and D

d. Both B and E

Answer: (d)

Solution:
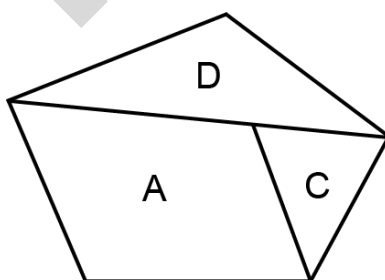
Therefore, option (d) is correct.

Question 53. A problem figure is given below. When it is folded into a cube. Which one of the cubes will be formed from the given cubes will be formed from the given alternatives?

a.

b.

c.

d.
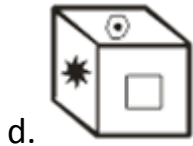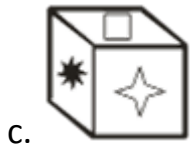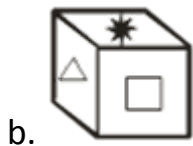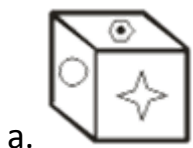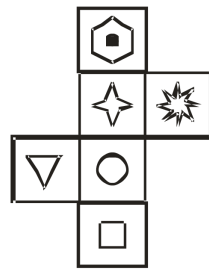
Answer: (d)

Solution:
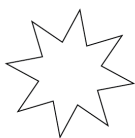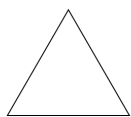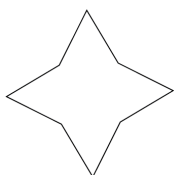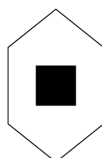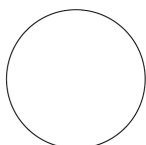
The figures which are in the opposite face can't come on the adjacent face.

Therefore, the correct option is (d).

Question 54. A problem figure is given of which the mirror image is X and the water image of X is Y. Identify the appearance of Y from the given alternative figures:

a.

b.

c.

d.

Answer: (b)

Solution:

Actual image   X   Mirror image

Y
Water image of X
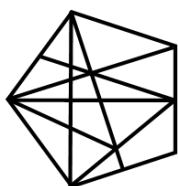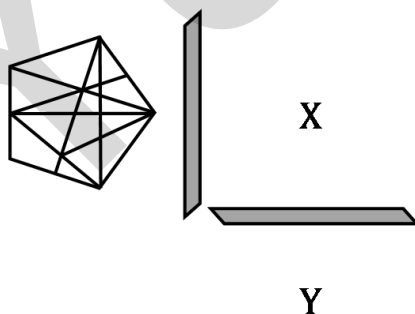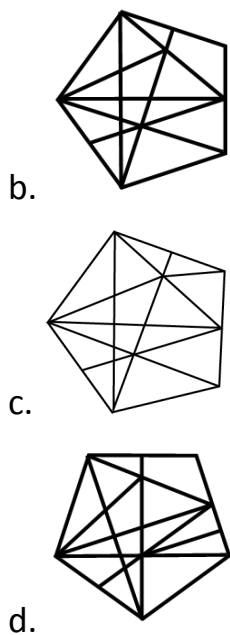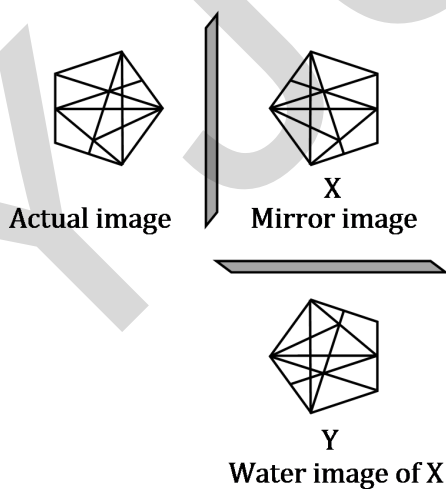
Therefore, the correct option is b).

Question 55. A hexagonal figure is given below. Identify which among the pieces A, B, C, D, E and F given below will NOT be required to complete the hexagonal figure.
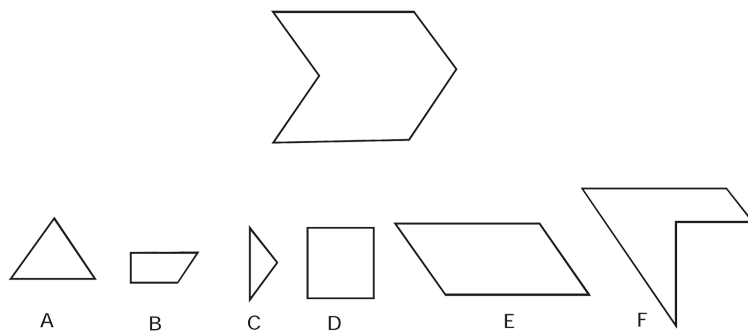
a. B

b. D

c. E

d. F

Answer: (b)

Solution:
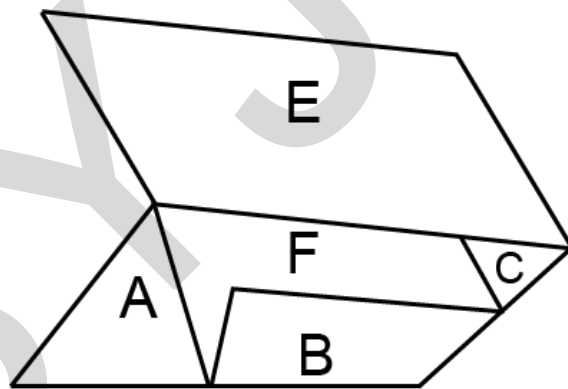
D is not required

Question 56. Which one of the given rules the number 70 follows?

a. $n^3 + 4n$

b. $2n^3 + 2n$

c. $n^3 + 3n/2$

d. $n^2 + 5n$

Answer: (c)

Solution:

By using option (c)

$n^3 + 3n/2$

When we use

n = 4 it gives 70

Question 57. What are the values of x and y in the given matrix?

	C_1	C_2	C_3
R_1	9	X	102
R_2	12	53	140
R_3	16	63	Y
R_4	13	50	118

a. 25, 136

b. 30, 148

c. 35, 128

d. 40, 156

Answer: (d)

Solution:

In C_1

16 + 9 − 12 = 13

13 = 13

Similarly to C_2

63 + x − 53 = 50

x = 103 − 63

x = 40

Similarly to C_3

y + 102 − 140 = 118

y = 258 − 102 = 156

x = 40

y = 156

Question 58. The numbers are arranged in a certain pattern. The values of a, b and c respectively in the pattern are:

		6	17	19	11	4		
	7	a	14	24	10	5	9	
1	6	8	18	34	b	9	7	3
	5	2	13	21	15	2	5	
		5	16	20	12	c		

a. 4, 16, 5

b. 3, 16, 7

c. 3, 15, 5

d. 2, 18, 7

Answer: (b)

Solution:

Value of a

$$\frac{(7+a+14+10+5+9)}{2} = 24$$

$$\Rightarrow \frac{a+45}{2} = 24$$

$$\Rightarrow a = 48 - 45 = 3$$

Value of b

$$\frac{(1+6+8+18+6+9+7+3)}{2} = 34$$

b + 52 = 68

b = 16

Similarly value of C

$$\frac{(5+16+12+C)}{2} = 20$$

C + 33 = 40

C = 7

a, b, c = **3, 16, 7**

Question 59. Direction: Take the given statements as true though in reality they may not be so and decide which of the conclusions logically follow from the statements?

Statements:

1. All the cucumbers are carrots.

2. Some carrots are brinjals.

3. All the brinjals are tomatoes.

Conclusions:

I. Some tomatoes are carrots.

II. All the carrots are tomatoes.

III. Some brinjals are cucumbers.

IV. All the brinjals are cucumbers.

a. Both the conclusion II and IV follows

b. Both the conclusion II and III follows

c. Both the conclusion III and IV follows

d. Both the conclusion I and III follows

Answer: Bonus

Solution:
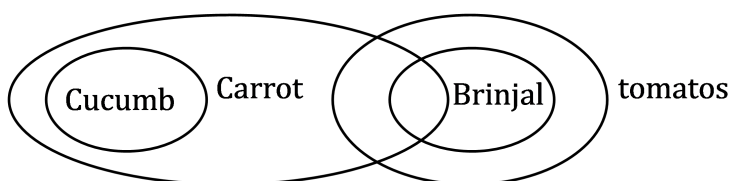
Only conclusion I follow.

Question 60. Aman, Ayaz and Ashwinder are members of a joint family. Among them Aman is the eldest of all.
Aman is six years elder than Ayaz.
Ayaz is eight years elder than Ashwinder.
The sum of the present ages of Aman and Ayaz is five times the age of Ashwinder four years ago.
Then the present age of Aman is :

a. 20 years
b. 24 years
c. 28 years
d. 32 years

Answer: (c)

Solution:
Let say ages of Aman is A
Ayaz is B
Ashwinder is C
Given
A = B + 6   …(1)
B = C + 8   …(2)
A + B = (C–4)   …(3)
So, A + B = 5C – 20
Put the value of eqn. (2) in eqn. (1)

We get

A = (C + 8) + 6

A = C + 14   …(4)

Now put the value of A and B in eqn.

$\Rightarrow$ C + 14 + C + 8 = 5C − 20

$\Rightarrow$ 2C + 22 = 5C − 20

$\Rightarrow$ 3C = 42

C = $\frac{42}{3}$ = 14

So, B = 22, A = 28

So, Aman's age is **28.**

Question 61. Direction: Complete the given analogy by choosing the correct group from the given alternatives

B F I D L : N R U P X :: A J E K C : ?

a. G M F I K

b. I G D K F

c. M V Q W O

d. K I F M G

Answer: (c)

Solution:
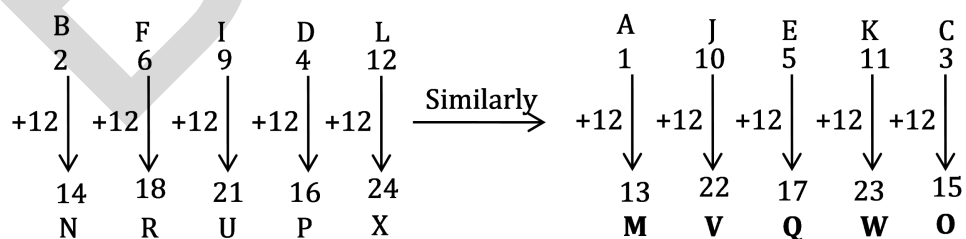
Therefore, option (c) is correct

Direction: (Question 62) In an extension of a city, the total population is 3000. the distribution of the population of 3000 people is as follows:

(1) Equal number of men and women are there in the age group of above 60 years.

(2) Number of male and female below 60 years are 1250 and 1150 respectively.

(3) Number of boys and girls below 18 years are 240 and 220 respectively.

Question 62. What is the difference between the female population of above 60 years and the adult female population below 60 years in the extension?

a. 850

b. 710

c. 630

d. 420

Answer: (c)

Solution:

Age	Male	Female
Above 60	A	A
Below 60	1250–240	1150–220
Above 18	1010	930
Below 18	240	220

Now total population = A+A+1010+930+240+220

$3000 = 2A + 2400 \Rightarrow A = 300$

Adult female are above 18 = 930

Now required difference

930 –300 = **630**

Therefore, option (c) is correct.

Question 63. A set of three number is given 484, 529, 961, Choose the set which is similar to the given set from the given alternatives.

a. 841, 625, 196

b. 729, 576, 324

c. 784, 676, 289

d. 441, 361, 225

Answer: (a) and (c)

Solution:

$4 + 8 + 4 \rightarrow 16$

$5 + 2 + 9 \rightarrow 16$

$9 + 6 + 1 \rightarrow 16$

Sum of digits in all numbers is same

Similarly,

$7 + 8 + 4 = 19$

$6 + 7 + 6 = 19$

$2 + 8 + 9 = 19$

option (c) is correct.

Also,

484, 529, 961 are the squares of 2 odd numbers and 1 even number.

Similarly, 841, 625, 196 are the squares of 2 odd numbers and 1 even number.

Option (a) is correct.

Question 64. What are the missing number in the third figure?
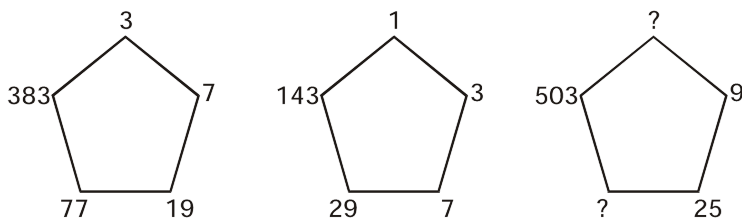
a. 2, 53

b. 4, 101

c. 5, 166

d. 6, 223

Answer: (b)

Solution:

$$77 = 19 \times 4 + 1$$
$$29 = 7 \times 4 + 1$$
$$25 \times 4 + 1 = \mathbf{101}$$

$$3 \times 2 + 1 = 7$$
$$1 \times 2 + 1 = 3$$
$$\mathbf{4} \times 2 + 1 = 9$$

So, the missing numbers are **4** and **101**.

Therefore, option (b) is correct.

Direction: (Question 65)

The unfolded figures of the same cube are shown with three different figures. The given three figures are folded in the shape of cube.
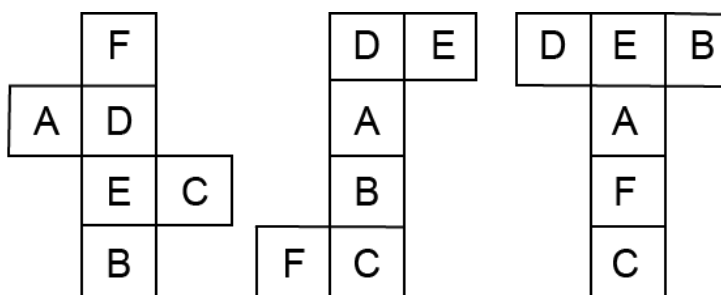
Question 65. In the alternatives, which one does NOT show the correct position of faces?

a.

b.

c.

d.
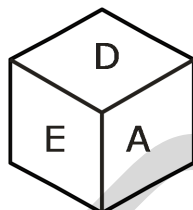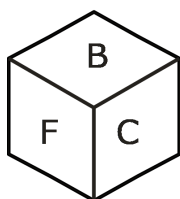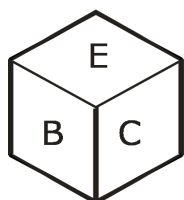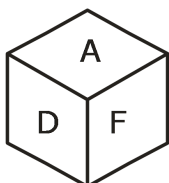
Answer: Bonus

Solution:

Folding this we get,

F opposite to E

B opposite to D

A opposite to C

All the options are possible as in none of the option opposite faces are placed
 adjacent.

Question 66. Direction: The different faces of a cube are shown through three folded cube shape. Identify which one of the figures given in the alternatives represents the unfolded cube.

a.

b.

c.

d.
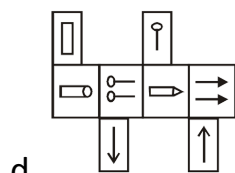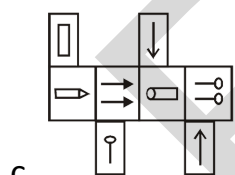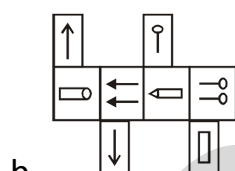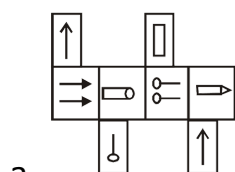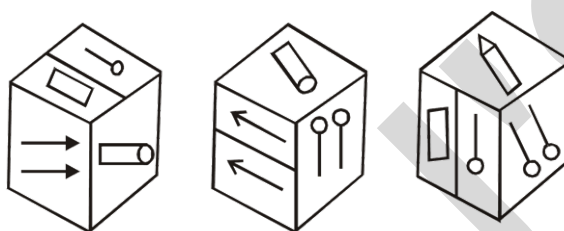
Answer: (d)

Solution:
observing the cube we get
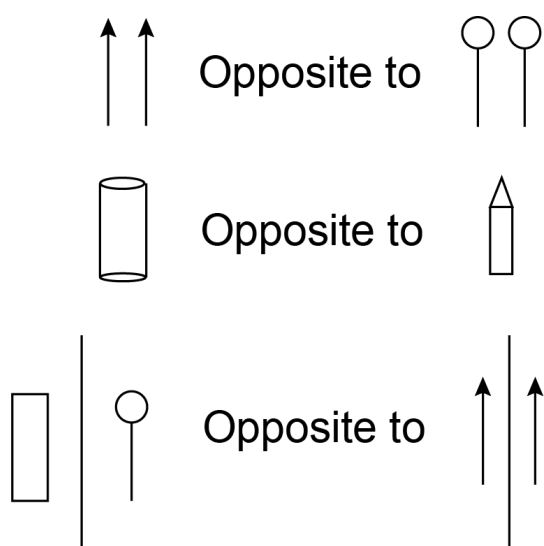
On unfolding cubes given we will get option (d) correct.

Direction (Question 67-68):

Read the information select carefully.

All the students in a school are divided into five house. Violet, Indigo, Green, Yellow and Red. All house perform from Monday to Friday in a week, such that only one house performs on one day. Yellow or Red should not be either the first or last to perform. Red house should be immediately followed by Green house, Indigo house should perform immediately after Yellow house. One house will perform between Violet and Indigo house.

Question 67. Which house is the first to perform?

a. Violet

b. Indigo

c. Green

d. Red

Answer: (a)

Solution:

According to given date

1	2	3	4	5
Monday	Tuesday	Wednesday	Thursday	Friday
↓	↓	↓	↓	↓
Violet	Yellow	Indigo	Red	Green.

First to perform is → **Violet.**

Question 68. Which house performed on 'Thursday'?

a. Red

b. Green

c. Indigo

d. Yellow

Answer: (a)

Solution:

1	2	3	4	5
Monday	Tuesday	Wednesday	Thursday	Friday
↓	↓	↓	↓	↓
Violet	Yellow	Indigo	**Red**	Green.

Thursday → **Red**

Question 69. What are the values of # and @ in the figure given below?
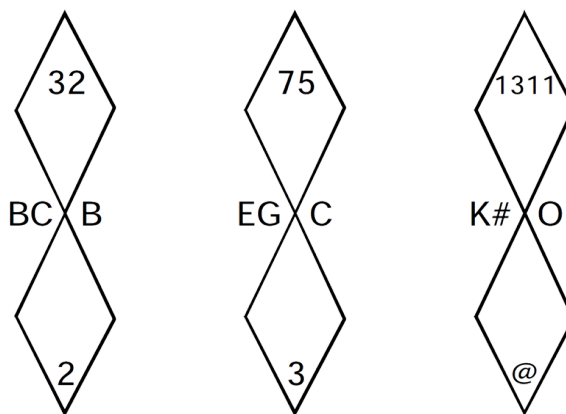
a. M, 15

b. M, 60

c. N, 30

d. N, 50

Answer: (a)

Solution:

C → 3   G → 7   # → 13

B → 2   E → 5   K → 11

B=2   C=3   O=@

So,

O = @ = 15
# = 13 = M
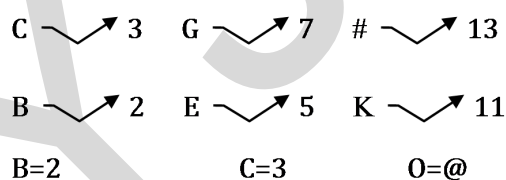
M, 15

Question 70. Which one of the following does NOT turn out to be meaningful by substitution of the set of signs (x, −, =, ÷), sequentially in the given alternatives?

a. 24 * 3 * 10* 120* 2

b. 12 * 4 * 8* 160*4

c. 10 * 8 * 16 * 192 * 3

d. 16 * 4 * 14 *200 * 4

Answer: (a)

Solution:

24×3–10 = 120 ÷ 2

72–10 = 60

62 ≠ 60

Option (a) does not satisfy.

Question 71. Statements:

A # B means 'A is the daughter of B'

A $ B means 'B is the brother of A'

A = B means 'B is the sister of A'

A % B means 'A is the son of B'

A * B means 'A is the father of B'

A @ B means 'A is the mother of B'

Assuming that spouse pair is unique, which of the following indicates 'R' is the grand – daughter of M?

a. M * T # 4 @ Z @ R = P
b. M * P # Y @ T @ Z = R
c. M = T @ Y @ Z # Z $ R
d. M @ T # Y = Z @ R * P

Answer: (b)

Solution:
M*P≠ Y & T@ Z = R

M×P≠ Y & T@ Z = R

Where□→male

◯→ Female

```
    ┌───┐                ┌───┐
    │ M │◄──────────────►│ Y │
    └───┘                └───┘
      │                    │
      │                    ▼
    ┌───┐                ┌───┐
    │ P │                │ T │
    └───┘                └───┘
                           │
                           ▼
                    Z ────────►Ⓡ
```
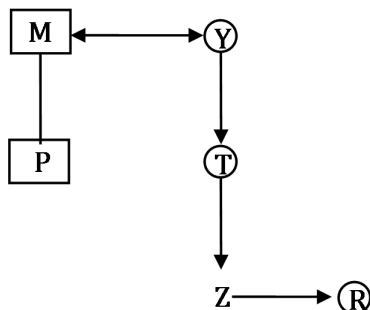
Therefore, option (b) is correct.

Question 72. Which of the following pair is different?
(16, 18); (56, 63); (96, 108); (86, 99)

a. 16, 18

b. 96, 108

c. 56, 63

d. 86, 99

Answer: (d)

Solution:

16 = 2 x 8

18 = 2 x 9

56 = 7 x 8

63 = 7 x 9

96 = 12 x 8

108 = 12 x 9

88 = 11 x 8

99 = 11 x 9

(86, 99) is not satisfying the pattern, it should be (88, 99)

Question 73. If you have to make the right side ball arrangement look like left side, how many minimum number of circles you would require to move?

Left side   Right side
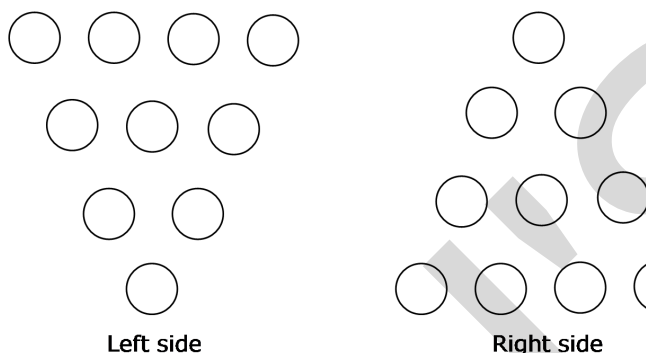
a. 3

b. 4

c. 5

d. 6

Answer: (a)
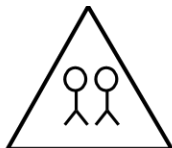
Solution:
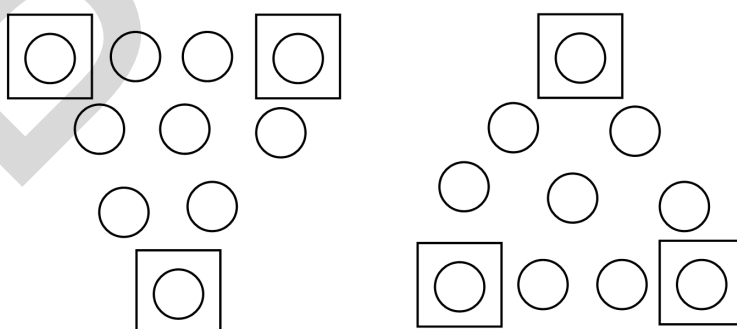
We have to move only 3

Question 74. Which figure comes in place of '?' in the figure given below?

a.

b.

c.

d.

Answer: (d)

Solution:

Difference between the first and third picture is equal to the middle.

Direction : (Question 75-76)

I. $\triangle$, $\bigcirc$, $\square$, $\otimes$ and $\sqcup$ are cousins

II. $\triangle$ is twice as old as $\bigcirc$

III. $\square$ is half the age of $\bigcirc$

IV. $\triangle$ is half the age of $\sqcup$

V. $\square$ is twice the age of $\otimes$

Question 75. Based on the above statements, find who is the second eldest amongst the five cousins?

a.

b.

c.

d.

Answer (b)

Solution:

$$\text{[cylinder]} = 2\,\triangle$$

$$\triangle = 2\,\bigcirc$$

$$\bigcirc = 2\,\square$$

$$\square = 2\,\otimes$$

In descending order,

$$\text{[cylinder]} > \triangle > \bigcirc > \square > \otimes$$

Second eldest is $\triangle$

Question 76. Who all are younger to O?

a. $\square$ $\otimes$

b. [cylinder] $\triangle$

c. $\square$ $\bigcirc$

d. [cylinder] $\otimes$

Answer: (a)

Solution:

$\text{⬭} = 2\,\triangle$

$\triangle = 2\,\bigcirc$

$\bigcirc = 2\,\square$

$\square = 2\,\otimes$

In descending order,

$\text{⬭} > \triangle > \bigcirc > \square > \otimes$

Younger to O is $\square$ $\otimes$

Question 77. Which numbers will replace the question marks if the numbers in the circles have linkages with:

3 15	4 0	4 45	5 30	? ?
7 20	7 55	8 30	? ?	9 40
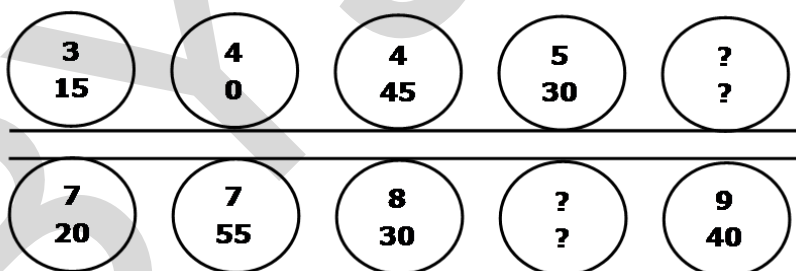
a. 5, 15; 8, 5
b. 5, 0; 8, 20
c. 6, 15; 9, 5
d. 6, 20; 9, 35

Answer: (c)

Solution:

3:15   4:00   4:45   5:30   6:15

+45 mins +45   +45   +45

7:20   7:55   8:30   9:05   9:40

+35 mins +35   +35   +35
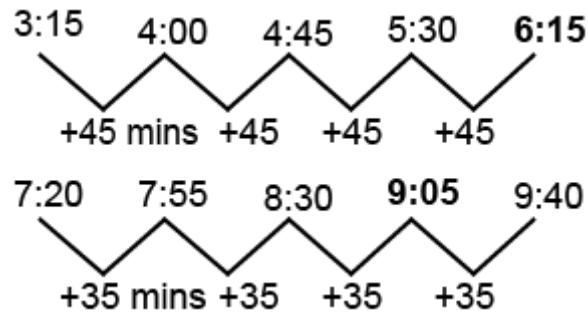
There are two sets of clocks placed with a time difference of 45min and 35min respectively.

Question 78. Find out the figure that does not match with the other figure.

A   B   C   D

a. A

b. B

c. C

d. D
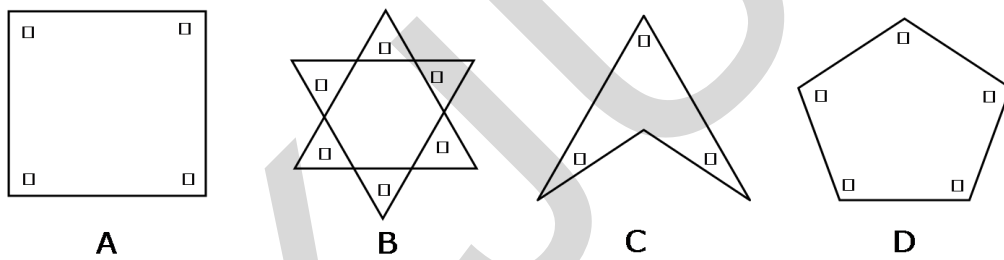
Answer: (c)

Solution:

No. of lines in figure is equal to number of square box made inside, which is not true only for figure c

Question 79. What are the numbers of blocks to be crossed for covering the shortest path from 'A' to 'B'? One cannot move diagonally and on a block with the number '2'.

A	1	2	1		2	2	2	2
2	1	1	2		3	3	1	2
1	3	2	1		1	2	3	2
1	2	1	1		1	2	3	2
3	2	1	3	1	3	2	3	1
1	2	2	1		2	2	2	1
1	1	2	3		3	1	3	1
2	3	2	1		1	2	2	2
1	1	3	1		3	3	1	B

a. 15

b. 19

c. 27

d. 37

Answer: (d)

Solution:

A	1	2	1		2	2	2	2
2	1	1	2		3	3	1	2
1	3	2	1		1	2	3	2
1	2	1	1		1	2	3	2
3	2	1	3	1	3	2	3	1
1	2	2	1		2	2	2	1
1	1	2	3		3	1	3	1
2	3	2	1		1	2	2	2
1	1	3	1		3	3	1	B

1, 1, 3, 1, 1, 3, 1, 1, 1, 3, 1, 3, 1, 1, 3, 1, 3, 1, 3, 1, 1, 3, 3, 1, 3, 3, 3, 1, 1, 1, 3, 1, 3, 1, 3, 3, 1

Question 80. One a staircase, Yaima is further up than Aloka but is lower than Srinivas. Ranjan is in the middle. Jeet is between Yaima and Ranjan. Aloka is between Ranjan and Danial. There is none below Barisha. Who is in the fifth position?

a. Aloka

b. Danial

c. Jeet

d. Yaima

Answer: (c)

Solution:

7 -Srinivas
6 -yaima
5 -Jeet
4 -Ranjan

3 -Aloka

2 -Daniel

1 -Barisha

Jeet is at fifth stairs

Direction (Question 81):

Yatin and Anandi are a married couple with two children, Krishi and Kaniki. Kaniki is married to Samson who is the son of Nui and Nirmaan. Mishi is the daughter of Samson. Aliza, who is Samson's sister is married to Hatim and has two sons, Kuku and Kiki. Nui is the grandmother of Kiki. Krishi is the maternaL aunt of Nishi.

Question 81. What is the difference between number of females and males in the generation to which Samson belongs?

a.1

b. 2

c. 3

d. 0

Answer: (a)

Solution:

Where male→⊕

female→⊖
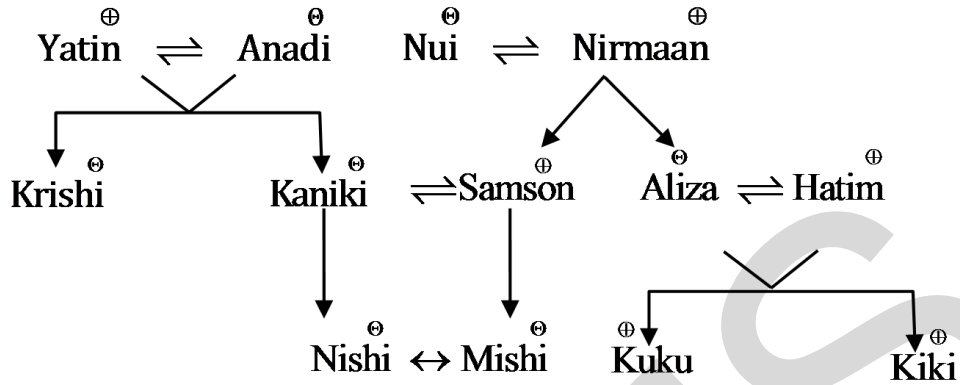
Samson Generation 2 male and 3 females so the difference is 1.

Question 82. Which figure completes the statement?

If [figure] **is to** [figure]

Then [figure] **is to?**

a. [figure]

b. [figure]

c.

d.
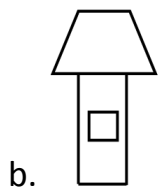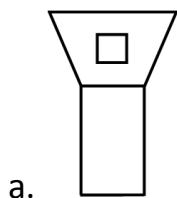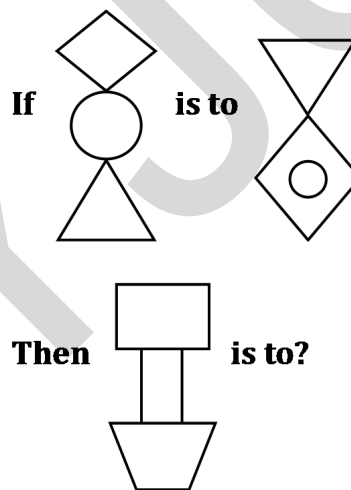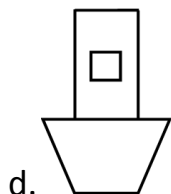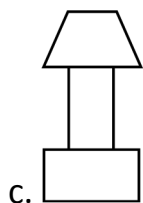
Answer (b)

Solution:

According to the given figure, the middle figure goes inside the upper figure and the lower figure becomes upside down and goes at the top.

Therefore, option (b) is correct

Question 83. Identify the box that can be formed from the sheet of paper given below:

| (I) | (II) | (III) | (IV) |
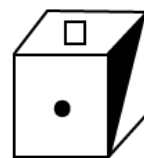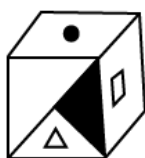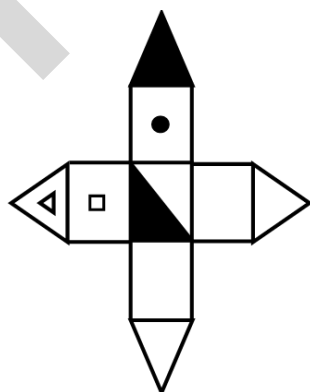
a. Only I

b. Only II and III

c. Only III

d. Only IV

Answer: (a)

Solution:

When we fold the given unfolded figure it becomes the figure which is in option I

Therefore, option (a) is correct.

Direction (Question 84-86):

Satisfy the following information and answer the given questions.

I.   B and E are good at fine Arts and Social Sciences.

II.   A and B are good at Social Sciences and Chemistry.

III.   A, D and C are good at Chemistry and Biology.

IV.   C and A re good at Chemistry and Physics.

V.   D and E are good at Biology and Fine Arts.

Question 84. Who is good in Chemistry, Biology and Physics but not in Social Sciences?

a. A

b. B

c. C

d. D

Answer: (c)

Solution:

Subjects/candidates	A	B	C	D	E
Fine art's		✓		✓	✓
Social science	✓	✓			✓
Chemistry	✓	✓	✓	✓	
Biology	✓		✓	✓	✓
Physical	✓		✓		

C has all three Chemistry, Biology, Physics and but not social.

Question 85. Who is good in Social Sciences, Biology and Fine Arts?

a. A

b. B

c. D

d. E

Answer: (d)

Solution:

All three (Social Sciences, Biology, Fine Arts) are present in E

Subjects/candidates	A	B	C	D	E
Fine art's		✓		✓	✓
Social science	✓	✓			✓
Chemistry	✓	✓	✓	✓	
Biology	✓		✓	✓	✓
Physical	✓		✓		

Therefore, option (d) is correct.

Question 86. Who is good in Chemistry, Fine Arts and Social Sciences?

a. A

b. B

c. D

d. E

Answer: (b)

Solution:

All three (Chemistry, Fine Arts, Social Sciences) are present in B

Subjects/candidates	A	B	C	D	E
Fine art's		✓		✓	✓
Social science	✓	✓			✓
Chemistry	✓	✓	✓	✓	
Biology	✓		✓	✓	✓
Physical	✓		✓		

Question 87. Observing the pattern given in the following sequence, identify the missing number in the sequence.

3, 18, 219, _____, 100005

a. 1743

b. 1746

c. 4096

d. 4100

Answer: (d)

Solution:

This sequence follows the pattern.
$2^1 + 1 = 3$

$4^2 + 2 = 18$

$6^3 + 3 = 219$

$8^4 + 4 = \mathbf{4100}$

$10^5 + 5 = 100,005$

Question 88. A solid cube of 4 cm side, painted on all its faces, is cut up into small cubes of 1 cm side. What is the ratio of the cubes without paint to the cubes with paint on exactly two faces?

a. 1 : 2

b. 1 : 3

c. 2 : 3

d. 3 : 2

Answer: (b)

Solution:

In a 4×4×4 side cube. Number of cubes which is unpainted = $(n–2)^3$

Where n = 4

Then $(4–2)^3 = (2)^3 = 8$

Number of cubes two face painted = 12 (n–2) = 12 (4–2)

= 12×2 = 24

Required ration = 8:24 = **1 : 3**

Question 89. A man walks 20m towards South, then after turning to his left, he walks 22m. Then he turns 90° in an anti-clockwise direction and walks 26m. Then again he turns to the left and walks up to 30m. How far (in metres) is the man from his initial position?

a. 16

b. 14

c. 10

d. 9

Answer: (c)

Solution:
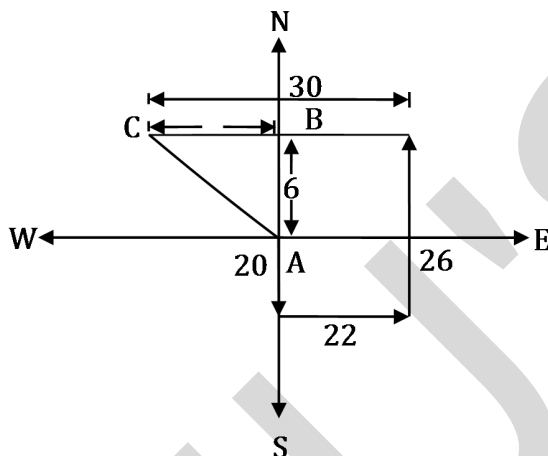
$$AC^2 = \sqrt{(AB)^2 + (BC)^2}$$

$$AC^2 = \sqrt{36 + 64}$$

$$AC = \sqrt{100}$$

AC = **10**

Question 90. What comes in the place of the blanks?

XXIV, XXII, XXV, XXIII, XXVI, _____, _____, XXV

a. XXIV, XXVII

b. XXVII, XXVIII

c. XXV, XXVI

d. XXIV, XXV

Answer: (a)

Solution:

By converting romons in numerals.

24,22,25,23,26,_,_,25

The pattern is to -2 and +3 alternatively.

24,22,25,23,26,**24,27**,25

Question 91. In which of the ways given in the options would you place the number 1-7 side by side, so that:

• **Then sum of the numbers 2 and 7 and all the numbers between them total 28.**

• **The sum of the numbers 3 and 6 and all the numbers between them total 14.**

• **The sum of the number 1 and 7 and all the numbers between them total 23.**

• **The sum of the number 2 and 4 and all the numbers between them total 10.**

a. 2 4 3 5 6 7 1

b. 1 2 3 4 5 6 7

c. 2 3 1 4 6 5 7

d. 3 2 1 5 6 7 4

Answer: (c)

Solution:

2 + 3 + 1 + 4 + 6 + 5 + 7 = **28**

3 + 1 + 4 + 6 = **14**

1 + 4 + 6 + 5 + 7 = **23**

2 + 3 + 1 + 4 = **10**

Therefore, option (c) is correct.

Question 92. Read the information and then select the correct option:

Fact 1: Islands are surrounded by water.

Fact 2: Mani is an island.

Fact 3: Mani was formed by a volcano.

If the above three statements are facts, which of the following statements must also be a fact?

I. Mani is surrounded by water.

II. All islands are formed by volcanoes.

III. All volcanoes are on islands.

a. I only

b. III only

c. I and III only

d. I and II only

Answer: (a)

Solution:

Only statement I is fact according to given Facts

Therefore, option (a) is correct.

Question 93. The vowels of English are coded by their letter numbers appearing as two digited and then reversed. Thereafter these numbers are represented through a Pie diagram. What will be the central angle (nearest to degree) of the sector representing 'U'?

a. 75

b. 78

c. 37

d. 20

Answer: (d)

Solution:

A	E	I	O	U
01	05	09	15	21

A $\rightarrow$ 10

E $\rightarrow$ 50

I $\rightarrow$ 90

O →51

U → 12

Central angle for U = $\frac{12}{10+50+90+51+12}$× 360

$= \frac{2}{213}$ ×360 = 20.28 $\simeq$ **20**

Question 94. For finding a numeric code of 3 digits, the following information is given:

A. | 6 | 8 | 2 | : Only one number is correct and properly placed.

B. | 6 | 1 | 4 | : One number is correct but wrongly placed.

C. | 2 | 0 | 6 | : Two numbers are correct but wrongly placed.

D. | 7 | 1 | 8 | : Nothing is correct.

E. | 7 | 8 | 0 | : One number is correct but wrongly placed.

The correct code is:

a. | 0 | 2 | 4 |

b. | 0 | 4 | 2 |

c. | 6 | 4 | 2 |

d. | 6 | 0 | 4 |

Answer (b)

Solution:

From D and E , it is clear that 7,1,8, are not any of the number, 0 is one of the number and is not in position third

From C it is clear that 0 is not in second position,

So, 0 is in first position.

0 _ _

From A it is clear that 2 is the correct number and is in third position as 6 can't come on first as it is already occupied by 0.

0 _ 2

From B it is clear that 4 is placed at third number

Hence the code is **0 4 2**

Question 95. What are the number of triangles that can be formed by connecting the vertices of a regular octagon with the condition that exactly one side of the triangle will be one of the sides of the octagon?

a. 18
b. 32
c. 48
d. 56

Answer: (b)

Solution:
From side we can form Δ's ABD,ABE,ABF,ABG this we can make a total 8×4 = **32** triangles.
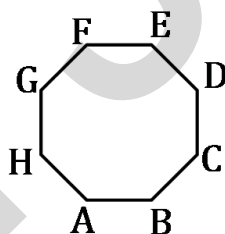
Therefore, option (b) is correct.

Question 96. Three students Shaurya, Ruhani and Seerat are standing in a queue. There are six students between Shaurya and Ruhani and nine students between Ruhani and Seerat. If there be exactly three students ahead of Seerat and 21 students behind Shaurya. What could be the minimum number of students in the given queue?

a. 22
b. 28

c. 29

d. 30

Answer: (b)

Solution:
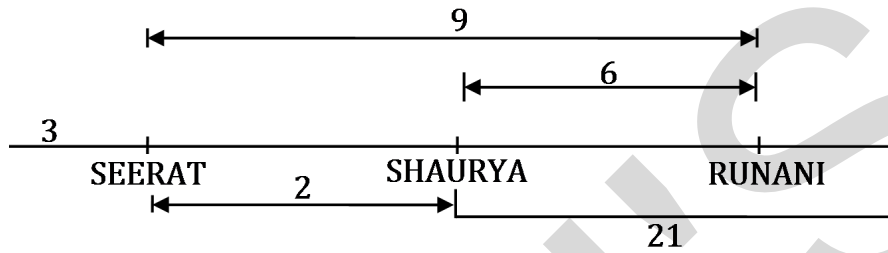
Minimum number = 3 + 1(Seerat) + 2 + 1(Shaurya) + 21 = **28**

Question 97.

The value of ◇ ◯ ▭ in the given matrix are respectively:

a. 16, 12, 9

b. 12, 15, 10

c. 9, 11, 17

d. 15, 10, 12

Answer: (d)

Solution:

$$\diamondsuit = A$$

$$\square = B$$

$$\bigcirc = C$$

A + B + C = 37 ------------- (1)

A + 2C = 35 ------------- (2)

2A+C = 40   ------------- (3)

By adding equation (2) and equation (3)

3A+3C=75

A+C = 25

⇒ B = 37 −25 = **12**

A+ 2C = 35 from (2)

A + C + C = 35

⇒ C = 35 -25 = **10**

⇒ A = **15**

A = $\diamondsuit$ = 15

B = $\square$ = 12

C = $\bigcirc$ = 10

Therefore, option (d) is correct.

Direction (Question 98-100):

A is the incharge of setting the speakers for a debate at school. In addition to the moderator, there will be speakers in favour and against the theme, Besides, there will be a person to maintain time and a reporter to record the points. The members involved in this programme are B, C, D, E and F.

- **The moderator must sit in the middle in seat number 3.**
- **The time-keeper cannot sit next to the reporter.**
- **B and F sit on either side of the moderator.**
- **B who is not the moderator sits between E and C.**
- **The moderator does not sit next to D or E.**
- **B the time-keeper sits on seat number 2.**

Question 98. Who is the moderator?

a. B

b. D
c. C
d. F

Answer: (c)

Solution:

(1) → (E) → Speaker.
(2) → (B) → Time keeper.
(3) → (C) → Moderator.
(4) → (F) → Speaker or reporter
(5) → (D) → Speaker or reporter.

C is moderator

Question 99. What is the seat number of E?

a. 1

b. 2

c. 3

d. 4

Answer: (a)

Solution:

(1) → (E) → Speaker.
(2) → (B) → Time keeper.
(3) → (C) → Moderator.
(4) → (F) → Speaker or reporter
(5) → (D) → Speaker or reporter.

1 is the seat number of E.

Question 100. Who are the speakers for the debate?

a. E & F

b. B & D

c. C & E

d. F & B

Answer: (a)

Solution:

(1) → (E) → Speaker.
(2) → (B) → Time keeper.
(3) → (C) → Moderator.
(4) → (F) → Speaker or reporter
(5) → (D) → Speaker or reporter.

E & F are the speakers for debate.

NATIONAL TALENT SEARCH EXAMINATION

(NTSE-2021) STAGE-2

PAPER: SAT (SET-A)

Date: 14-02-2021   **Time allowed: 120 mins**   **Max. Mark: 100**

BIOLOGY

Question 1. A taxonomist during his voyage found a solitary marine animal with spines on skin made of calcium carbonate. However, its coelom was made of pouches pinched off from endoderm. Assign the specimen to the most appropriate Phylum.

a. Chordata

b. Nematoda

c. Coelenterata

d. Echinodermata

Answer: (d)

Solution:
Characters given such as:

- Solitary marine animal

- Spines on skin made of calcium carbonate

- Coelomate - coelom made of pouches pinched off from endoderm

All these features given are of phylum Echinodermata.

Question 2. An individual with genotype AaBbCcddEe is crossed with another individual with genotype AabbCcDdEe. Assuming Mendelian pattern of inheritance, predict the proportion of aabbccddee among the progeny of this cross?

a. 1/32

b. 1/64

c. 1/128

d. 1/256

Answer: (d)

Solution:

AaBbCcddEe × AabbCcDdEe

Here, each gene is crossed separately and the probability of desired gene is obtained by multiplying the probability of each gene as shown below:

Aa x Aa --- AA Aa Aa aa, Probability of aa = 1/4

Bb x bb --- Bb Bb bb bb, Probability of bb = 2/4

Cc x Cc --- CC Cc Cc cc, Probability of cc = 1/4

dd x Dd --- Dd dd Dd dd, Probability of dd = 2/4

Ee x Ee --- EE Ee Ee ee, Probability of ee = 1/4

Probability of aabbccddee = 1/4 x 2/4 x 1/4 x 2/4 x 1/4 = 1/256

Question 3. Which one of the four methods of propagation is likely to lead to maximum variation in DNA sequence through generations?

a. Budding in Hydra

b. Binary fission in Amoeba

c. Reproduction in human beings

d. Vegetative propagation of sugarcane

Answer: (c)

Solution:

Human beings are sexually reproducing organisms. In this process, two parents are involved in producing a new individual. Offspring are produced by the fusion of gametes (sex cells) from each parent. Hence, the newly formed individual will be different from parents, both genetically and physically. Whereas budding, binary fission, and vegetative propagation are asexual mode of reproduction which involve single parent, hence the offsprings produced will be similar to the parent.

Question 4. A case of bio-magnification was being studied. A laboratory received equal quantities of three samples M, N and O. The levels of pesticides found in these samples are as follows: M-1 mg, N-0.2 mg. O-3 mg.

The samples M, N and O respectively could be:

a. Grass, grasshoppers and adipose tissue of birds.

b. Grasshoppers, grass and adipose tissue of birds

c. Grass, adipose tissue of birds and grasshoppers

d. Adipose tissue of birds, grasshoppers and grass

Answer: (b)

Solution:
In the process of biomagnification the concentration of pesticides keeps on increasing with increase in the trophic level in a food chain. The food chain given in the question is as follows:

Grass $\longrightarrow$ Grasshopper $\longrightarrow$ Birds (Adipose tissue)

Conc. $\longrightarrow$ 0.2 (N)   1 (M)   3(0)

Question 5. Illustration of a pyramid of number of an aquatic ecosystem is given.

Sea Lion
Herring
Zooplankton
Phytoplankton
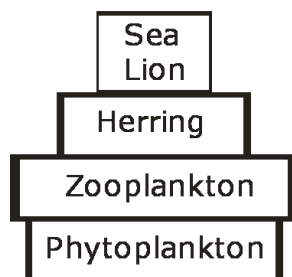
The pyramid of energy for the same ecosystem would be:

a.
Sea Lion
Phytoplankton
Herring
Zooplankton

b.
Phytoplankton
Zooplankton
Herring
Sea Lion

c.
Sea Lion
Herring
Zooplankton
Phytoplankton

d.
Sea Lion
Herring
Zooplankton
Phytoplankton

Answer: (d)

Solution:

According to the 10% law of energy flow given by Lindeman, there is a loss of energy at each subsequent trophic level and only 10% of energy is transferred to the next trophic level. The maximum energy is in the first trophic level. Hence the pyramid of energy for the given ecosystem would be:
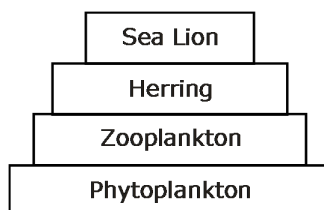
Question 6. Which of the following traits would an evolutionary biologist consider to understand the divergent evolution process?

a. Hind limb of sheep, flipper of whale and wing of a bat.

b. Flipper of shark, flipper of penguin and flipper of dolphin.

c. Bat wing, bird wing and wing of a butterfly.

d. Human arm, seal forelimb and wing of a bird.

Answer: (d)

Solution:
Divergent evolution is a characteristic property related to homologous organs. Human arm, forelimb of a seal and wing of a bird share common ancestry, that is, they have similar structure but do different functions.

Question 7. In adjacent agricultural lands of nearly equal dimensions, two farmers A and B had cultivated crops of their choice and observed standard practices. A pathogen attacked the crops and destroyed it in the land belonging to farmer A. as a result of which he suffered complete loss. Although the pathogen attacked the adjacent land belonging to farmer B, he was able to earn some money by selling the yield. The possible explanation for the above is

a. Farmer A must have cultivated only one crop whereas Farmer B must have cultivated two crops.

b. Farmers A and B must have cultivated the same crop with a fence between the two agricultural lands.

c. Farmer A over irrigated the crop due to which it attracted the pathogen.

d. Farmer B removed weeds from the cultivated land.

Answer: (a)

Solution:

When two or more crops are grown on the same land simultaneously, it is known as mixed cropping. Farmer B must have cultivated 2 crops (mixed cropping) so that one crop will be saved if another crop gets destroyed by pathogens.

Question 8. A biology teacher placed a hen's egg in three different solutions:

Solution A: Pure water,

Solution B: saturated salt solution,

Solution C: Hydrochloric acid,

The sequence of treatments and the ensuing probable effect on the egg are listed below;

I. A → B → C → Remains unchanged

II. B → C → A → Swells

III. C → A → B → Shrinks

 IV. B → A → C → Loses salts

Based on the above sequence to treatment which one of the option will be correct?

a. I and II

b. I and IV

c. II and III

d. III and IV

Answer: (c)

Solution:

Egg shells are impermeable to water and saturated salt solution but when egg is placed in HCl then the egg shell (which is made of $CaCO_3$) will be dissolved and a semi permeable membrane will be exposed.

Now in this condition the egg will gain/swell when put in water and will shrink when put in concentration salt solution.

Question 9. Observe the flow chart below.
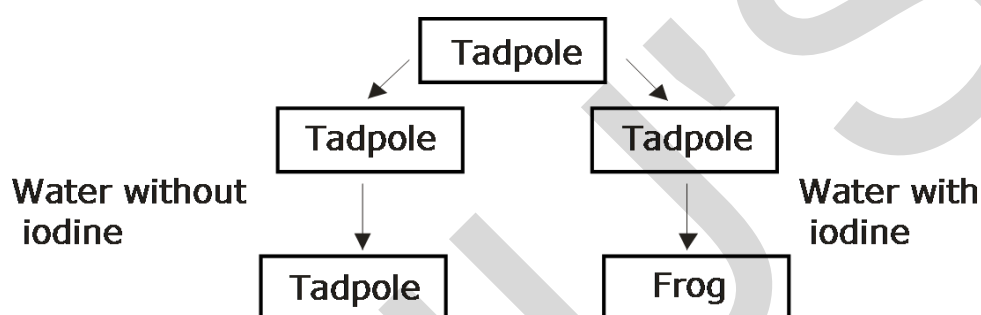
Which of the following best explains the observed results?

a. Iodine helps to produce thyroxine.

b. Iodine inhibits thyroid gland activity.

c. Absence of Iodine leads to starvation.

d. Iodine promotes cell growth and division

Answer: (a)

Solution:

Thyroxine hormone is responsible for metamorphosis in tadpoles.

Thyroxine hormone is formed in the presence of iodine.

Question 10. An experiment conducted in the laboratory is tabulated below.

Test tube A	Test Tube –B	Test –C

Saliva	**Starch**	**Starch**
+	**+**	**+**
Iodine	**Saliva**	**Saliva**
↓	↓	**+**
incubation	**incubation**	**Enzyme inhibitor**
		↓
		incubation
		+
		Iodine
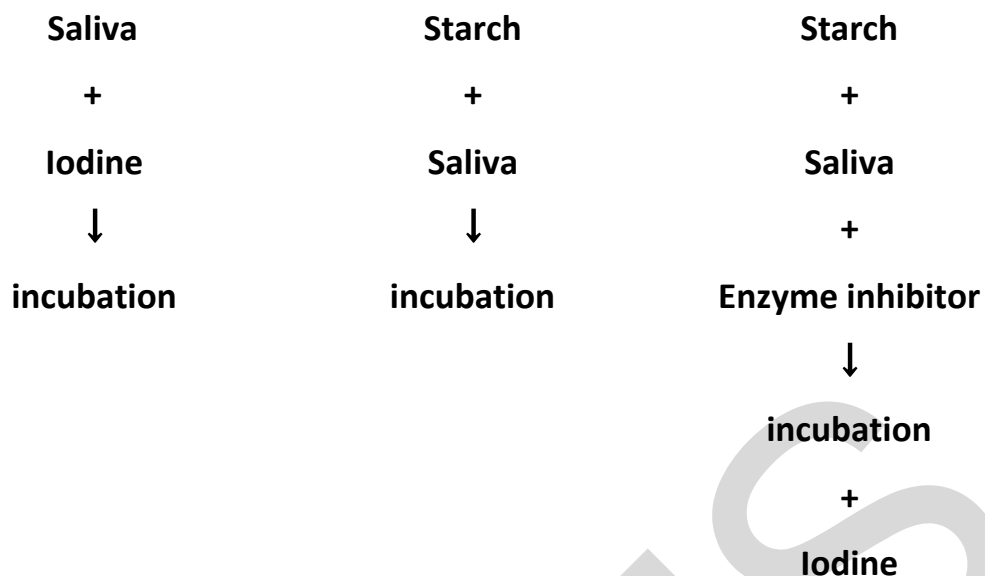
What would be the colour observed in test tubes A, B and C at the end of the experiment?

a. A – Yellow, B- No color, C – Blue black

b. A – No color, B- Blue black, C- Yellow

c. A – Blue black, B- Yellow, C- No color

d. A – No color, B – Yellow, C- Blue black

Answer: (a)

Solution:
Test tube A

Saliva + Iodine _→ Incubation = Yellow

Since no starch is present, it shows the yellow colour of iodine.

Test tube B

Starch + saliva _→ incubation = No colour

Salivary amylase present in the saliva breaks down starch into maltose. Hence no colour is observed.

Test tube C

Starch + saliva + enzyme inhibitor _→ incubation + iodine = blue black

Here, due to the presence of enzyme inhibitors the salivary amylase will not be able to break down starch. The starch reacts with iodine to give blue black colour.

Question 11. The presence of a specific molecule (called markers) in an organelle can be used to identify the presence of that organelle. A researcher has three test tubes with organelles. A, B and C, each of which shows the presence of one marker as shown below:

Organelle	Marker	Function of the marker
A	Cytochrome oxidase	Involved in ATP synthesis
B	Ribosomal RNA	Part of ribosome
C	Acid hydrolysis	Degrades different molecules

Based on the information given in the table, identify the organelles A, B and C.

a. A: Plastids; B: Rough Endoplasmic Reticulum (RER); C: Lysosomes

b. A: Mitochondria; B: Rough Endoplasmic Reticulum (RER); C: Lysosomes

c. A: Mitochondria; B: Smooth Endoplasmic Reticulum (SER); C: Golgi apparatus

d. A: Plastids; B: SER; C: Golgi apparatus

Answer: (b)

Solution:

Organelle A — Mitochondria — involved in ATP synthesis

Organelle B — (RER) Rough Endoplasmic reticulum — have ribosome

Organelle C — lysosomes — Degrades different molecules by acid hydrolase

Question 12. Positions of endocrine glands are labeled A – E in the given diagram. Match the symbols of glands in column 1 with the type of hormone it secretes given in column 2.

Column 1	Column 2	
A	I.	Progesterone
B	II.	Insulin
C	III.	Parathyroid hormone
D	IV.	Melatonin
E	V.	Follicle stimulating hormone
	VI.	Thyroxine
	VII.	Aldosterone

Choose the correct combination from the following:
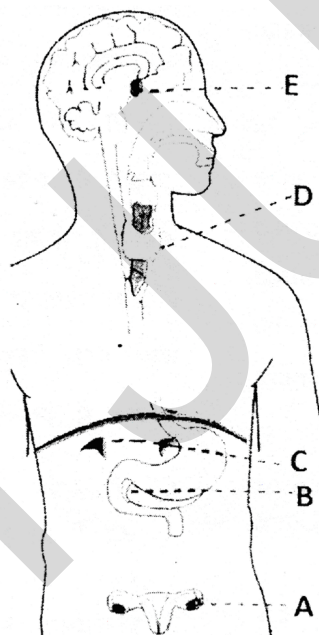
a. A-I, B-II, C-VII, D-III, E-V

b. A-I, B-IV, C-II, D-III, E-VI

c. A-V, B-II, C-IV, D-III, E-VII

d. A-V, B-IV, C-VII, D-III, E-II

Answer: (a)

Solution:
Column I   Column II

A. (Ovary)   I.   Progesterone

B. (Pancreas)   II.   Insulin

C. (Adrenal gland)   VII. Aldosterone

D. (Parathyroid gland)   III.   Parathyroid hormone

E. (Pituitary gland)   V.   Follicle stimulating hormone

Question 13. Virulent forms of the bacterium staphylococcus aureus is a human pathogen. Some strains of which cause – 'flesh eating disease'. Earlier the antibiotic Penicillin was used to control this pathogen. After some years Penicillin was ineffective. Hence a powerful antibiotic- Methicillin was used in treatments. Subsequently, Methicillin also became ineffective and the strains showed resistance to multiple antibiotics also called "multi-drug resistance". Which one of the following statements regarding development of multi-drug resistance is correct?

a. Antibiotics led to mutation in the DNA of bacterium thus creating drug resistant strains.

b. Antibiotics helped in the selection for bacterium with mutation in the DNA conferring drug resistance which were already present in the population

c. Even without the use of antibiotics the drug resistant strains would have evolved at the rate as observed in the above situation.

d. Presence of antibiotics induces changes in the metabolism of the bacterium leading to drug resistance.

Answer: (b)

Solution:

Given antibiotic penicillin was used to control this pathogen after which methicillin was used as penicillin became ineffective. Gradually methicillin also became ineffective so it led to 'multi' drug resistance. This is probably because antibiotics helped in the selection for bacteria with mutations in the DNA conferring drug resistance which were already present in the population.

Question 14. 1.80 g of glucose ($C_6H_{12}O_6$) was dissolved in 36g of water. The number of oxygen atom in solution are:

a. 6.68×10^{23}

b. 12.40×10^{22}

c. 6.68×10^{22}

d. 12.40×10^{23}

Answer: (d)

Solution:

No. of atoms of oxygen in glucose = $\frac{1.80}{180} \times N_A \times 6$

No. of atoms of oxygen in water = $\frac{36}{18} \times N_A \times 1$

= $0.06 \times N_A + 2 \times N_A$

= $2.06 \times N_A$

= $2.06 \times 6.023 \times 10^{23}$

= 12.40×10^{23}

Question 15. Consider the following statements:

I. F, Cl, N and O are electronegative elements.

II. Electrons in the atoms given in statement I are in K and L shell only

III. Tendency of forming cations decrease in second period of periodic table upto F

Correct statement (s) is/are

a. I only

b. I and II only

c. I and III only

d. I, II and III

Answer: (c)

Solution:

Statement I and III is correct as in chlorine three shells are present.

K   L   M

2   8   7

As electronegativity increases across the second period, the tendency to form cation decreases.

Question 16. Let T = Temperature, H = Humidity, and V = Wind speed

Which of the following are the best suited conditions for drying up of clothes?

a. T = 40°C, H = 10%, V = 45 m/s

b. T = 28°C, H = 20%, V= 35 m/s

c. T = 20°C, H = 30%, V = 25 m/s

d. T = 15°C, H = 40%, V = 15 m/s

Answer: (a)

Solution:

Rate of evaporation increases with increase in temperature and speed of wind and decreases with increase in humidity.

Question 17. 100 mL of solution containing 0.1 mole of NaOH per litre was mixed with 100 mL solution containing 0.02 mole of H_2SO_4 per litre. The amount of NaOH in the mixture in grams will be

a. 0.12

b. 0.24

c. 2.4

d. 0.36

Answer: (b)

Solution:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$$
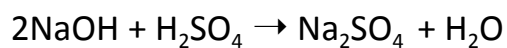
Milliequivalent of NaOH = 0.1 x 100 x 1 = 10

Milliequivalent of H_2SO_4 = 0,02 x 100 x 2 = 4

After neutralisation, remaining millimoles of NaOH = 10 - 4 = 6

Mass = 6 x 10-3 x 40 = 0.24 g

Question 18. On oxidation with alkaline KMnO$_4$ followed by acidification of the reaction mixture, which one of the following alcohols would produce an acid having three structural isomers?

a. Propanol

b. Butanol

c. Pentanol

d. Hexanol

Answer: (c)

Solution:

$CH_3CH_2CH_2CH_2CH_2OH$ undergoes oxidation with KMnO$_4$ to give $CH_3CH_2CH_2CH_2COOH$.

$$CH_3 - CH_2 - CH_2 - CH_2 - COOH$$

$$CH_3 - CH - CH_2 - COOH$$
$$\mid$$
$$CH_3$$

$$CH_3 \quad$$
$$\mid$$
$$CH_3 \text{—} C \text{——} COOH$$
$$\mid$$
$$CH_3$$
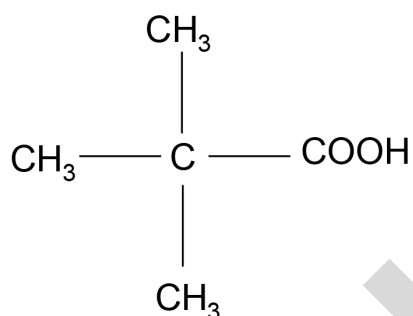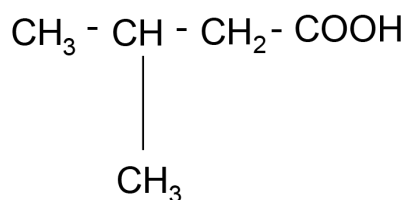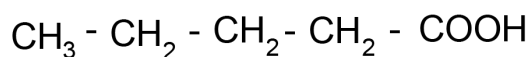
Question 19. Atomic number of an element Z is 16. Element Z has two isotopes Z_1 and Z_2 with 16 and 18 neutrons, respectively. The average atomic mass of a sample of the element Z is 32.1 u. Which one of the following percentages of Z_1 and Z_2 in the sample is correct?

	Z_1	Z_2
a.	95%	5%
b.	94%	6%
c.	93%	7%
d.	92%	8%

Answer: (a)

Solution:

Average atomic mass = $\frac{mass \times abundance + Mass \times Abundance}{100}$

Atomic No: = 16

Mass of Z_1 = 16 + 16 = 32

Mass of Z_2 = 16 + 18 = 34

$32.1 = \frac{32 \times x + 34(100 - x)}{100}$

$3210 = 32x + 3400 - 34x$

$190 = 2x$

$x = 95 \%$

Thus, $Z_1 = 95$ and $Z_2 = 5\%$.

Question 20. Detergents are also called surface active agents (surfactants). These have two distinct parts: one hydrophilic spherical part and another hydrophobic long tail made of carbons chain. Two experiments 'A' and 'B' were carried out. In experiment 'A', surfactant was added in a beaker containing water. In experiment 'B', surfactant was added in a beaker containing hexane.

Following are possible results in these experiments:

I.   In experiment 'A' (see figure 'a') micelle is formed, where hydrophobic part is inside the micelle and hydrophilic part is outside the micelle.
II.   In experiment 'B' (see figure 'b') micelle of reverse type is formed where hydrophilic part is inside the micelle and hydrophobic part is outside the micelle.
III.   Micelle of reverse type is formed in experiment 'A'.
IV.   Micelles are large enough to scatter light in 'A'.

Correct observation are
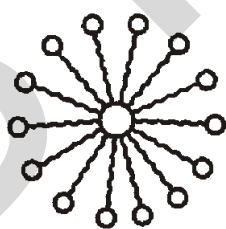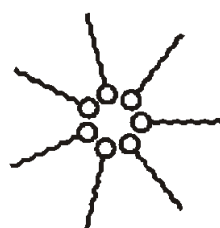
Figure 'a'   Figure 'b'

a. I, II & III only

b. I, II & IV only

c. I, III & IV only

d. II, III & IV only

Answer: (b)

Solution:

In experiment A, surfactant was added in a beaker containing water (polar). Thus a micelle is formed where the hydrophilic part is in contact with water and the hydrophobic part is inside as shown in figure 'a'.

In experiment B, surfactant was added in a beaker containing hexane (organic solvent). Thus, the hydrophobic part is in contact with hexane which is non-polar in nature.

Question 21. Reaction of organic compound 'A' with 'B' in acidic condition gives compound 'C'. Compound 'B' reacts with alkaline KMnO$_4$ solution and gives compound 'A'. Compound 'C' gives compound 'B' as one of the product when reacted with sodium hydroxide solution. Which of the following statement is/are correct

I. 'A' is CH$_3$COOH

II. 'B' is CH$_3$CH$_2$OH

III. 'C' is CH$_3$COOCH$_2$CH$_3$

IV. 'A' is sweet smelling substance

a. I and II only

b. I, II and III only

c. I, III and IV only

d. III and IV only

Answer: (b)

Solution:

$$CH_3COOH + CH_3\text{-}CH_2OH \xrightleftharpoons{\text{Acid}} CH_3\text{-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-}O\text{-}CH_2\text{-}CH_3 + H_2O$$

'A'　　　　　'B'　　　　　　　　'C'

$$CH_3CH_2OH \xrightarrow{\text{Alkaline KMnO}_4 + \text{Heat}} CH_3COOH$$

'B'　　　　　　　　　　'A'

$$CH_3\text{-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-}O\text{-}CH_2\text{-}CH_3 \xrightarrow{\text{NaOH}} C_2H_5OH + CH_3COONa$$

'C'　　　　　　　　　'B'
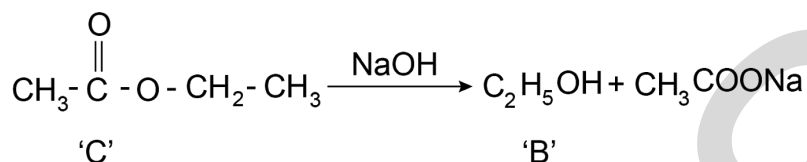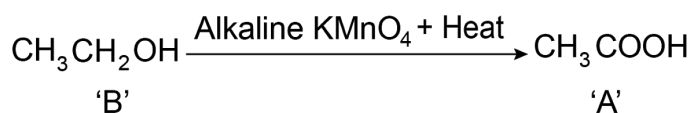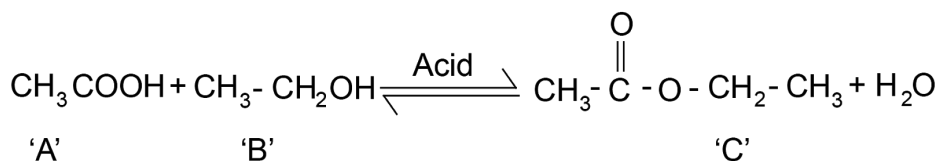
Ester (C) is a sweet smelling substance.

Question 22. Equal volumes of solutions containing 1 mole of an acid and 1 mole of a base respectively are mixed. Which of these mixtures will give pH more than 7?

a. Sodium hydroxide + Acetic acid

b. Potassium hydroxide + Sulphuric acid

c. Ammonium hydroxide + Sulphuric acid

d. Sodium hydroxide + Hydrochloric acid

Answer: (a)

Solution:

Acetic acid (Weak Acid) + Sodium Hydroxide (Strong Base) → Sodium Acetate (Basic)

Sulphuric acid (Strong Acid) + Potassium Hydroxide (Strong Base) → Potassium Sulphate (Neutral)

Sulphuric Acid (Strong Acid) + Ammonium hydroxide (Weak base) → Ammonium sulphate (Acidic)

Hydrochloric Acid (Strong Acid) + Sodium hydroxide (Strong Base) → Sodium Chloride (Neutral)

Question 23. A part of the modern periodic table is shown below in which elements have been represented by English letters of the alphabet.

Group →	1	2	13	14	15	16	17
Period ↓							
1	A						
2	B		H		J	K	
3	C	E					
4	D	F				M	
5	N						

On the basis of the above periodic table, which one of the following statements is incorrect?

a. M will have −1 valency

b. C will form an ionic compound with K

c. H will form a covalent compound with A

d. B is small in size as compared to D and K

Answer: (d)

Solution:

Statement (d) is incorrect. Atomic size of B is greater than K as nuclear charge increases as we move from left to right in a period.

Question 24. Consider the electrochemical cells (I and II) shown in the following figures and select the correct statement about these cells
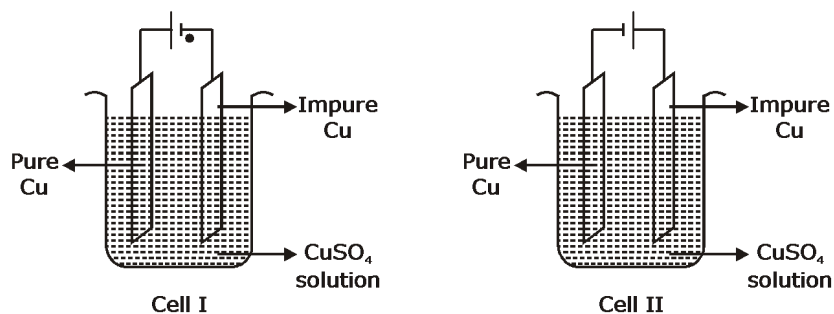
Cell I   Cell II

a. Cell I produces purer copper than cell II

b. In both cells, insoluble impurities settle down

c. Copper from cathode will deposit on anode in cell I

d. Copper from anode will deposit on cathode in cell II

Answer: (d)

Solution:

Cell II is the correct representation for electrolytic refining of copper. In this cell, cathode is a strip of pure copper whereas anode is impure copper. The pure copper is deposited on the cathode on passing electric current.

Question 25. Read the following table:

Metal	Reaction with		
	$ZnSO_4$ Solution	$FeSO_4$ Solution	$CuSO_4$ Solution
X	No reaction	No reaction	No reaction
Y	No reaction	No reaction	Displacement Reaction
Z	Displacement Reaction	Displacement Reaction	Displacement Reaction

Based on the above table consider the following statements

I.   Reaction of Y with $CuSO_4$ solution produces Cu metal.
II.   Z is the most reactive element and X is the least reactive.
III.   Y is more reactive than X and less reactive than Z.
IV.   Metal Y produces Zn on reaction with $ZnSO_4$ solution.

Which of the following options gives the correct statements?

a. I, II & III only
b. I, III & IV only

c. II & III only
d. III & IV only

Answer: (a)

Solution:

A more reactive element can displace a reactive metal from its salt solution.

i. Y undergoes displacement reaction with $CuSO_4$ giving aqueous solution of YSO_4 and copper.
ii. Order of Reactivity: Z > Y > X
iii. Y is less reactive than Zn and hence do not produce Zn on reaction with zinc sulphate solution.

Question 26. If excess of CO_2 is passed through the suspension of a compound 'X' in water, a compound 'Y' is formed. Substances 'X' and 'Y' dissolve in H_2SO_4 giving white compound 'Z' which is insoluble in water. Identify the compounds 'X', 'Y' and 'Z'.

a. $CaSO_4$, $CaCO_3$, gypsum
b. $CaSO_4$, $CaHCO_3$, lime
c. $CaCO_3$, $CaHCO_3$, $CaSO_4$
d. $CaHCO_3$, $CaCO_3$, $CaSO_4$

Answer: (c)

Solution:

$$\underset{\substack{\text{'X'} \quad \text{(excess)}}}{CaCO_3 + CO_2 + H_2O} \longrightarrow \underset{\text{'Y'}}{Ca(HCO_3)_2}$$

$$\underset{\text{'X'}}{CaCO_3 + H_2SO_4} \longrightarrow \underset{\text{'Z'}}{CaSO_4} + H_2O + CO_2$$

$$\underset{\text{'Y'}}{Ca(HCO_3)_2 + H_2SO_4} \longrightarrow \underset{\text{'Z'}}{CaSO_4} + 2H_2O + 2CO_2$$

Question 27. Figures given below show velocity-time curves for a moving object. Identify the one which may be realised in practice.

a.

b.

c.

d.
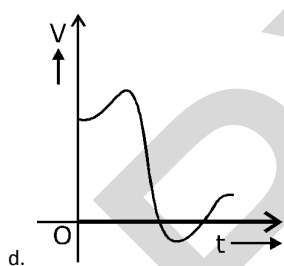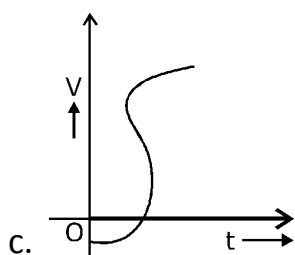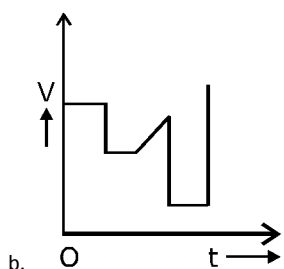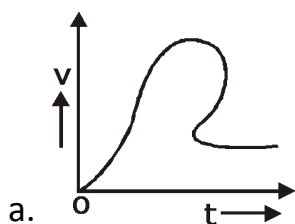
Answer: (d)

Solution:

In option (1) and (3), there will be more than one velocity at a time. So, they are not possible in option (2) the slope is infinite at a particular time instant t (means acceleration will be infinite). It is also not possible.

Therefore the option (4) represent the motion of particle.

Question 28. Two balls A and B are released towards point W from point X and point Z respectively, on a perfectly smooth track as shown in the figure. The balls move along the track without losing contact. What will be the ratio of their speeds (V1/v2) at point W?
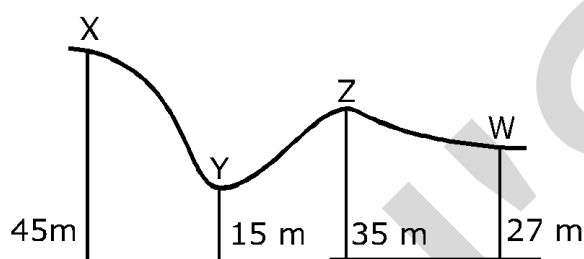
a. 1

b. $\frac{1}{2}$

c. $\frac{2}{3}$

d. $\frac{3}{2}$

Answer: (d)

Solution:

P.E at point W = mg × 27   (P.E. = mgh}

P.E at point X = mg × 45

P.E at point Z = mg × 35

K.E at point W of Ball A. = mg (45 −27) = mg × 18   {By the conservation of energy}

K.E at point W of Ball B = mg (35 − 27) = mg 8

Ratio of K.E $= \dfrac{\frac{1}{2}mv_1^2}{\frac{1}{2}mv_2^2} = \dfrac{mg \times 18}{mg \times 8} = \dfrac{9}{4}$ (K.E. = $\frac{1}{2}$ mv²}

∴ Ratio of velocity $= \dfrac{v_1}{v_2} = \dfrac{3}{2}$

Question 29. A marble P of mass 'm' lies at rest on the edge of a perfectly horizontal surface of a table of height 'h' as shown in the figure. A second identical

marble Q having same mass moving at a speed 'u' strikes it perfectly elastically. The speed acquired by marble. P after the collision is:

[In an elastic collision, momentum as well as kinetic energy are conserved]
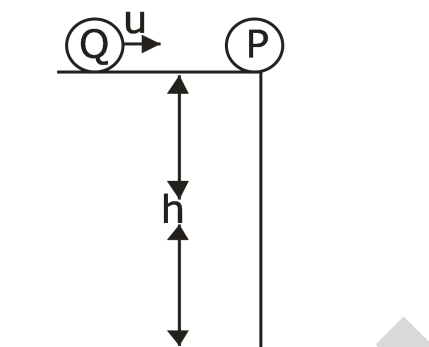
a. 0

b. $\frac{1}{2}u$

c. u

d. 2u

Answer: (c)

Solution:

Given

velocity of P = u_2 = 0

Velocity of Q = u_1 = u

for elastic collision e = 1

As we know the coefficient of restitution

$e = \frac{v_2 - v_1}{u_1 - u_2} \left(\frac{velocity \ of \ separation}{velocity \ of \ approach} \right)$

$1 = \frac{v_2 - v_1}{u - 0}$

u = $v_2 - v_1$ ...(1)

Also momentum is conserved

$mu_1 + mu_2 = mv_1 + mv_2$

$mu = m(v_1 + v_2)$

$u = v_1 + v_2$ ...(2)

Solving (1) and (2)

$v_2 - v_1 = v_1 + v_2$

$2v_1 = 0$

$v_1 = 0$

$v_2 = u$

In elastic collision if masses are identical only the velocity will interchange.

Therefore after collision velocity of Q will become 0 and of P becomes U.

Question 30. A block floats with its fraction η_E inside water when immersed in a beaker containing water and kept on the earth. The beaker along with the block is shifted to the surface of the moon. If η_M is the fraction of the block now immersed in water, which of the following relations is correct?

a. $\eta_M = \frac{1}{6}\eta_E$

b. $\eta_M = 6\eta_E$

c. $\eta_M = \eta_E$

d. $\eta_M = \frac{1}{\sqrt{6}}\eta_E$

Answer: (c)

Solution:

A object is float when

Buoyant force – Wight of object

$\rho\ vg = mg$

On earth

$\rho_l g\ V_{immersed} = \rho_s g\ V_s$

$\therefore V_{immersed} = \left(\frac{\rho_s}{\rho_l}\right)V_s$

Or $\frac{V_{immersed}}{V_s} = \frac{\rho_s}{\rho_l}$ ....(1)

On moon

$\rho_l\ \frac{g}{6}\ V_{immersed} = \rho_s\ \frac{g}{6}\ V_s$

Or $\quad \frac{V_{immersed}}{V_s} = \frac{\rho_s}{\rho_l}$ $\qquad$ ....(2)

From equation (1) & (2)

or ⚓ $\frac{\rho_s}{\rho_l}$ = Relative density and it is same for both the condition

∴ $V_{immersed} = V_s$

or $\eta_E = \eta_M$

Question 31. The weight of an object on a planet is 0.25 times of its weight on earth. A pendulum clock that ticks once every second on earth is taken to the planet. On that planet the clock would tick once in every?

a. 1.0 s
b. 2.0 s
c. 3.0 s
d. 4.0 s

Answer: (b)

Solution:

Given:
$mg' = (0.25)mg \Rightarrow g' = \frac{g}{4}$

Let acceleration due to gravity on planet → g

On earth $T_1 = 2\pi \sqrt{\frac{l}{g}}$ $\qquad$ (Time period of pendulum $T = 2\pi\sqrt{\frac{l}{g}}$}

$I = 2\pi\sqrt{\frac{l}{g}}$ $\qquad$ ...(1) $\qquad$ T_1 = 1sec (given)

On planet $T_2 = 2\pi\sqrt{\frac{l}{g'}} = 2\pi\sqrt{\frac{l}{\frac{g}{4}}} = 2\times 2\pi\sqrt{\frac{l}{g}}$

From equation (1)

T_2 = 2 × 1 = 2sec.

Question 32. A ball is thrown vertically upwards at a speed u and returns back to the thrower. There are two instants at which the ball has equal kinetic and potential energies. The difference between these two instants is:

a. $\frac{1}{\sqrt{2}}\left(\frac{u}{g}\right)$

b. $\frac{u}{g}$

c. $\sqrt{2}\left(\frac{u}{g}\right)$

d. $2\left(\frac{u}{g}\right)$

Answer: (c)

Solution:

Given:

$\frac{1}{2}mv^2 = mgh$

From 1 & 2nd equation of motion

$V = u + gt$

$h = ut + \frac{1}{2}gt^2$

So, $\frac{1}{2}m(u-gt)^2 = mg(ut - \frac{1}{2}gt^2)$ (∵ a = -g)

$\frac{1}{2}[u^2 + g^2t^2 - 2ugt] = ugt - \frac{1}{2}g^2t^2$

$\frac{u^2}{2} + \frac{1}{2}g^1t^2 - ugt = ugt - \frac{1}{2}g^2t^2$

$g^2t^2 - 2ugt + \frac{u^2}{2} = 0$

$t = \frac{2ug \pm \sqrt{4u^2g^2 - 4g^2\frac{u^2}{2}}}{2g^2}$

$t = \frac{2ug \pm \sqrt{2u^2g^2}}{2g^2}$

$t = \frac{2\ u \pm \sqrt{2}u}{2g}$

taking (+) sign $t_1 = \frac{2\ u + \sqrt{2}u}{2g}$

taking (−) sign $t_2 = \frac{2\ u - \sqrt{2}u}{2g}$

∴ Difference between the instant to

$t_1 - t_2 = \frac{2\ u + \sqrt{2}u}{2g} - \frac{2u - \sqrt{2}u}{2g} = \frac{\sqrt{2}u + \sqrt{2}u}{2g}$

$= \sqrt{2}\left(\frac{u}{g}\right)$

Question 33. The potential energy stored in a spring when compressed by a length 'x' is $\frac{1}{2}kx^2$ and the force required to compress it is 'kx'; 'k' is a constant of the

spring known as spring constant. The spring is placed on a floor upright and a stone of mass

10 kg falls and hits the spring with a speed 10 m/s. The spring is compressed by 5 cm. Assuming that there is no loss of energy, what is the value of 'k'?

[Given : acceleration due to gravity is 10 m/s^2]

a. 2.0×10^{-2} N/m

b. 8.0×10^4 N/m

c. 4.0×10^5 N/m

d. 2.0×10^6 N/m

Answer: (c)

Solution:

Given:

$W = \frac{1}{2} Kx^2$

$F = Kx$

$M = 10$ kg

$V = 10$ m/s

$X = 5$ cm $= 0.05$ m

By the conservation of energy

$\frac{1}{2} mv^2 + mgh = \frac{1}{2} kx^2$

$\Rightarrow \quad K = \frac{mv^2 + 2mgh}{x^2}$

$= \frac{10 \times 10^2 + 2 \times 10 \times 10 \times 0.05}{(0.05)^2} = 40.4 \times 10^4 \frac{N}{m}$

Or $K = 4.04 \times 10^5$ N/m

$\simeq \quad 4 \times 10^5$ N/m

Question 34. A girl drops a ball from a height h = 20 m. It strikes the ground elastically and returns to her hand. An echo of the thud of the ball striking the ground is produced from a nearby cliff.

The echo is heard at exactly the same moment when the ball returns to the girl's hand.

(Take g = 10 m/s² and v$_{sound}$ = 350 m/s.) The distance of the cliff from the girl is close to

a. 350 m

b. $350\sqrt{2}m$

c. 700 m

d. 3500 m

Answer: (a)

Solution:

Given

h = 20m

V$_{sound}$ = 350 m/sec

g = 10

from 2nd equation of motion
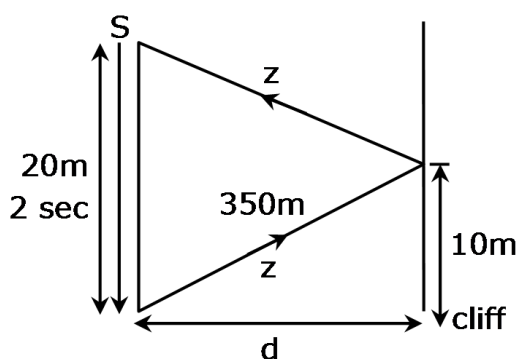
$S = ut + \frac{1}{2} gt^2$

$20 = \frac{1}{2} (10)t^2$

$40 = 10t^2$

$t = 2sec$

This is the time when ball strike to the ground.

Let Z is the distance from ground to cliff when ball strike to the ground.

Echo is occurred when sound wave is reflected

$\therefore$ Sound heard by girl

Speed of sound = $\frac{distance}{time}$

$350 = \frac{2Z}{2}$

Now, $\frac{2z}{2} = 350$

$Z = 350$ m

$(350)^2 = (10)^2 + d^2$

$(350)^2 - 100 = d^2$

$\sqrt{122400} = d$

$d = 349.35$ m $\cong$ 350 m

Question 35. Four graphs between $\frac{1}{u}$ and $\frac{1}{v}$ are given for spherical mirrors. Which one of them suitably represents a convex mirror, as per the new Cartesian sign convention?

a.

$\frac{1}{v}$

$\frac{1}{u}$

b.

$\frac{1}{v}$

$\frac{1}{u}$

c.

$\frac{1}{u}$

$\frac{1}{v}$

d.

$\frac{1}{u}$

$\frac{1}{v}$
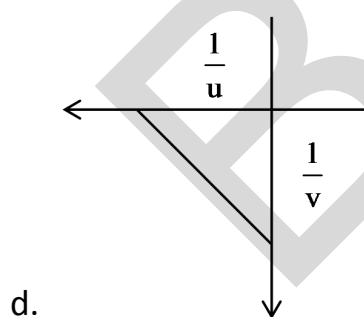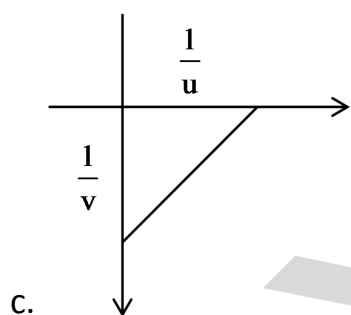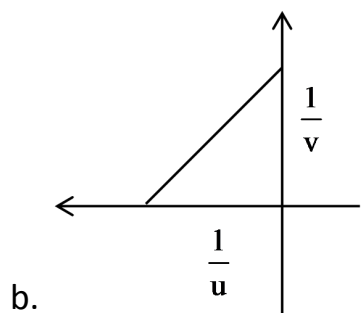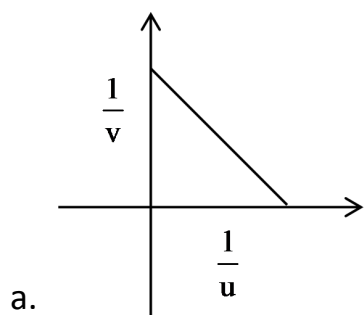
Answer: (b)

Solution:

Since, v is always +ve for convex mirror

By the mirror formula

So, $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{f} - \frac{1}{u}$

$V > 0 \, ; \, f > 0 \, ; \, u < 0$

Now, $y = mx + c$

$y = \frac{1}{v} \quad c = \frac{1}{f}$

$x = \frac{-1}{u}$

Question 36. An object is placed at point A in front of a convex lens of focal length f. Its real inverted and magnified image is formed behind the lens. When the object is brought closer to the lens and placed at a point B a virtual and erect image but with exactly the same magnification (in magnitude) as before is formed is front of the convex lens. Let F be the focus of the lens in front of it. Which of the following relations is correct?

a. AF = FB
b. AB = f
c. AF − BF = f
d. AB = 2F

Answer: (a)

Solution:
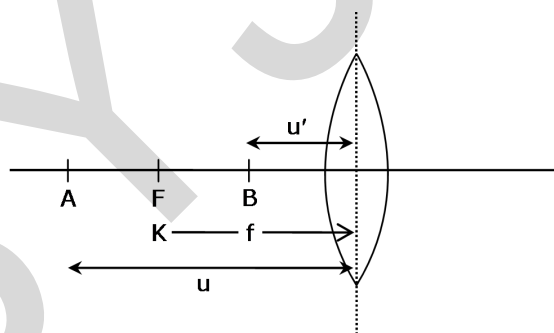
Magnification $m = \frac{v}{u} = \frac{f}{f+u}$

Case – I → When image is real & inverted

$m_1 = \frac{f}{f-u}$ ...(1)

Case – II → When image is virtual & erect

$m_2 = \frac{f}{f-u'}$ ...(1)

Given that $m_1 = m_2$

∴ from equation (1) & (2)

$f - u = f - u'$

From figure → u = f + FA

u′   = f – FB

So, f – (f + FA) = f – (f – FB)

AF = FB

Question 37. Nethra, who is a back bencher, discovers one day in the class that she is unable to discern the details on the blackboard very well. When the visits an optician, he prescribes glasses for her.

Which of the following statement(s) is/are false?

I.   She surffers from myopia where the far point in nearer than the blackboard.

II.   A concave lens with a suitable power can help correct her vision.

III.   Her eye is detective and is forming images in front of the retina.

IV.   A concave lens or a convex lens may be used to correct her vision.

a. Only I

b. II and III

c. I, II and IV

d. Only IV

Answer: (d)

Solution:

As the board is far away

∴Nethra is suffering from near sightedness (myopia)

Myopia is corrected by using concave lens and in myopic eye the image forms in front of retina.

∴ Statement I, II and III are correct

Question 38. Consider three resistors of resistance R_1, R_2 and R_3 such that $R_1 < R_2 < R_3$. Two of them are connected in parallel, and then connected in series with the third. Which one of the following configuration yields the highest current when connected to the same battery?

a. R_1 and R_2 in parallel, with R_3 in series

b. R_1 and R_3 in parallel, with R_2 in series

c. R_2 and R_3 in parallel, with R_1 in series

d. It will depend on the precise value of R_1, R_2 and R_3.

Answer: (c)

Solution:

According to the ohm's law

$\frac{V}{R_{eq}} = I$

∴ For I to be maximum in circuit the equivalent resistance of circuit (Req) should be minimum.

When two resistors are connected in parallel combination Req is less than least individual resistance.

∴ Connecting R_2 and R_3 in parallel will decrease the value.

Question 39. Figure shows three electrical appliances connected to a 220V as main. What is the amperage (current rating) of the fuse that should be used in the circuit?
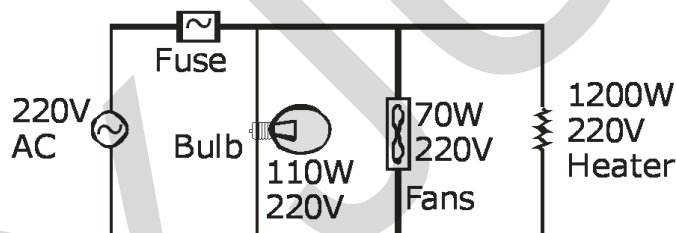
a. 1.0 A

b. 2. 0 A

c. 5.0 A

d. 10.0 A

Answer: (d)

Solution:

The power consumption is given by

P = $\frac{v^2}{R}$

R = $\frac{v^2}{P}$

Since all are connected in parallel

Resistance of bulb = $\frac{(220)^2}{110}$ = 440 Ω

Resistance of fan (R_2) = $\frac{(220)^2}{70}$ = 691.4 Ω

Resistance of Heater = $\frac{(220)^2}{1200}$ = 40.33 Ω

$\frac{1}{Req} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_2}$

$\frac{1}{Req} = \frac{1}{440} + \frac{1}{691.4} + \frac{1}{40.33}$

Req = 0.027

According to ohm's law

V = IR

I = $\frac{V}{R}$ = $\frac{220}{0.027}$

I = 5.94 ≅ 6A

So, current rating of the fuse should be 10A.

Question 40. A positive charged plate and a negatively charged plate are kept parallel to each other at a distance of 10 cm. An electron is released near the negative plate. Looking from the negative plate towards the positive plate, the magnetic field produced by the moving electron will be:

a. clockwise

b. anti-clockwise

c. positive to negative plate

d. negative to positive plate

Answer: (b)

Solution:
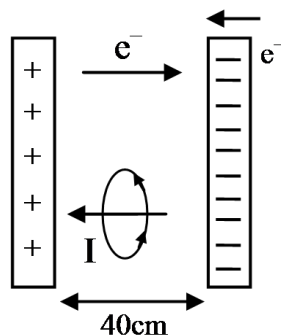
Since, the direction of I is opposite to the direction of the flow of electrons.

So, according to maxwell's right hand Thumb Rule;

Direction of the magnetic field will be anticlockwise.

MATHEMATICS

Question 41. If $x = \dfrac{\sqrt{5}-\sqrt{2}}{2\sqrt{3+\sqrt{5}-\sqrt{2}}}$, then the value of $\dfrac{x\sqrt{10}+\sqrt{2}}{x\sqrt{10}+2\sqrt{5}}$ is

a. $\dfrac{15+\sqrt{10}}{41}$

b. $\dfrac{15-\sqrt{10}}{41}$

c. $\dfrac{15+\sqrt{10}}{43}$

d. $\dfrac{15-\sqrt{10}}{47}$

Answer: (c)

Solution:

$x = \dfrac{\sqrt{5}-\sqrt{2}}{2\sqrt{3+\sqrt{5}-\sqrt{2}}}$

$x = \dfrac{\sqrt{5}-\sqrt{2}}{\sqrt{2}\sqrt{\{(\sqrt{5}+1)^2-1\}}}$

x = $\frac{\sqrt{5}-\sqrt{2}}{\sqrt{10}}$

$x\sqrt{10} = \sqrt{5} - \sqrt{2}$

Put the value of $x\sqrt{10}$ in given equation

$$\frac{x\sqrt{10}+\sqrt{2}}{x\sqrt{10}+2\sqrt{5}} = \frac{\sqrt{5}-\sqrt{2}+\sqrt{2}}{\sqrt{5}-\sqrt{2}+2\sqrt{5}} = \frac{\sqrt{5}}{3\sqrt{5}-\sqrt{2}} = \frac{15+\sqrt{10}}{43}$$

Question 42.On dividing a natural number x by 11, the remainder is 3, and on dividing x by 17, the remainder 9, if the number x lies between 300 and 400, then the remainder on dividing x by 21 is

a. 9 but not 11

b. 11 but not 9

c. both 9 and 11

d. neither 9 or nor 11

Answer: (a)

Solution:

N = 11p + 3

N = 17q + 9

N + 8 = 11(p + 1) = 17(q +1)

L.C.M. of (11, 17) = 187

187– 8 = 179

x lies b/w 300 and 400

Required number = 179 + 187 = 366

When 366 is divided by 21 then the remainder is 9.

Question 43. If (ax + b)(x^5 + 1) – (5x + 1) is divisible by x^2 + 1, then the value of 2a + 3b

a. 5

b. 10

c. 12

d. 13

Answer: (d)

Solution:

(ax + b)(x^5 + 1) – (5x + 1) is divisible by x^2 + 1

So, x^2 = -1 will be the zero of the equation

$ax^6 + bx^5 + ax + b - 5x - 1$

Putting the values

$x^2 = -1$, $x^4 = 1$, $x^6 = -1$ we get

$- a + bx + ax - 5x + b - 1 = 0$

$b - a - 1 = 0$

a + b = 5   ...(i)
b – a = 1   ...(ii)
On adding eq.(i) and (ii)
2b = 6
⇒ b = 3
now, a + 3 = 5
⇒ a = 2
Put the value of a and b in eq.
2a + 3b
2 × 2 + 3 × 3
4 + 9 = 13

Question 44. Suppose the graphs of 15x + 20y = − 2 and x − y = − 2 intersect at a point P. If the graph of 2x + 3y = k²passes through P, then k is

a. an integer

b. a positive integer

c. a negative integer

d. not an integer but rational

Answer: (a)

Solution:

15x + 20y = − 2   ...(i)

x − y = − 2   ...(ii)

15x + 20y = x − y

14x = − 21y

2x + 3y = 0

$k^2 = 0$

Question 45. The sum of the squares of the third and the thirteenth terms of an A.P. is 5, and the product of the fourth and twelfth terms is R. Then, the product of the third and thirteenth terms of the AP is

a. $\frac{80+50R}{41}$

b. $\frac{80+50R}{82}$

c. $\frac{100R-45}{82}$

d. $\frac{100R-45}{41}$

Answer: (c)

Solution:

$(a + 2d)^2 + (a + 12d)^2 = 5$ ... (1)

$(a + 3d) \times (a + 11d) = R$ ... (2)

$(a + 2d)(a + 12d) = ?$

$\Rightarrow$ $(a + 2d + d)(a + 12d - d) = R$

$(a + 2d)(a + 12d) - d(a + 2d) + d(a + 12d) - d^2 = R$

$(a + 2d)(a + 12d) - d(-10d) - d^2 = R$

$(a + 2d)(a + 12d) + 9d^2 = R$

$K = R - 9d^2$ ... (3)

From (1) $[(a + 12d) - (a + 2d)]^2 + 2(a + 12d)(a + 2d) = 5$

$\Rightarrow 100d^2 + 2K = 5$

$2K = 5 - 100d^2$ ... (4)

$(3) \times 100 - (4) \times 9$

$100K = 100R - 900d^2$

$-18K = -45 + 900d^2$

$K = \frac{100R - 45}{82}$

Question 46. If α and β are the roots of the quadratic equation $2x^2 - 5x - 6 = 0$ and

$P_{n+1} = \alpha^n - \beta^n$, then the value of $\frac{P_9 - 3P_7}{4P_8}$ is

a. $\frac{3}{8}$

b. $\frac{5}{8}$

c. $\frac{7}{8}$

d. $\frac{9}{8}$

Answer: (b)

Solution:

$$P_{n+1} = \alpha^n - \beta^n \qquad\qquad 2x^2 - 5x - 6 = 0$$

$$= \frac{P_9 - 3P_7}{4P_8} \qquad\qquad 2P_n - 5P_{n-1} - 6P_{n-2} = 0$$

$$= \frac{2P_n - 6P_{n-2}}{8\,P_{n-1}} \qquad\qquad P_n - 3P_{n-2} = \frac{5}{2}P_{n-1}$$

$$= \frac{P_n - 3P_{n-2}}{4P_{n-1}} = \frac{5}{8}$$

Question 47. A number is picked up at random from the numbers from 1 to 1000.

The probability that it is of the form m^n (where m > 1, n > 1) is

a. $\frac{1}{20}$

b. $\frac{1}{25}$

c. $\frac{1}{30}$

d. $\frac{1}{39}$

Answer: (b)

Solution:

total outcomes = 1000

$3^2, 4^2 \ldots\ldots 31^2 = $ **29**

$2^3, 5^3, 6^3, 7^3, 8^3 = $ **5**

All power 4 already included in power 2

$2^5, 3^5 = $ **2**

$2^6, 3^6 = $ **2**

$2^7 = 1$

2^8 (already included in power 2)

$2^9 = 1$

Favorable outcomes = 40

$$\frac{40}{1000} = \frac{1}{25}$$

Question 48.Let A (–5, 5), B(4, –5) and C(4, 5) be the vertices of the triangle ABC. If a circle passes through the vertices of $\triangle$ABC then the area (in sq. units) lying inside the circle but outside the $\triangle$ABC is

a. $\frac{181}{2}\pi - 45$

b. $\frac{181}{2}\pi - 40$

c. $\frac{181}{4}\pi - 45$

d. $\frac{181}{4}\pi - 40$

Answer: (c)

Solution:
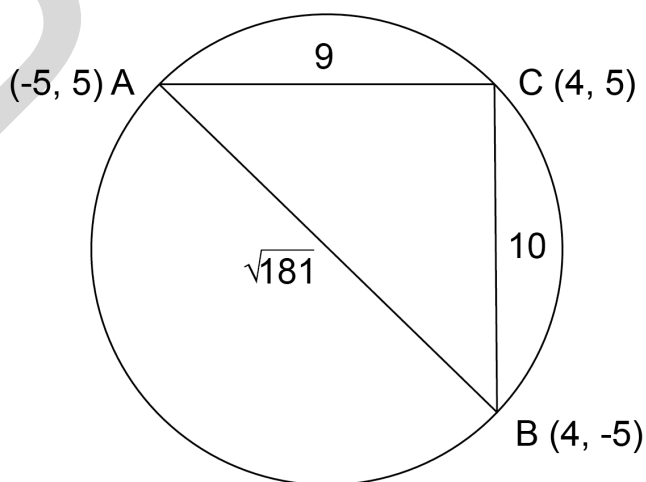
Area of $\triangle ABC = \frac{1}{2} \times 10 \times 9 = 45$

$\therefore$ AB is diameter then r = $\frac{\sqrt{181}}{2}$

Area of shaded region = πr^2 – area ($\triangle ABC$)

= $\frac{\pi(181)}{4} - 45$

Required area = $\frac{181\pi}{4} - 45$

Question 49.The coordinates of points A, B and C are (7, 4), (3, 1) and (0, k)

respectively. Then the value of k, such that AC + BC is minimum

a. $\frac{-5}{4}$

b. $\frac{19}{10}$

c. $\frac{5}{4}$

d. $\frac{9}{10}$

Answer: (b)

Solution:
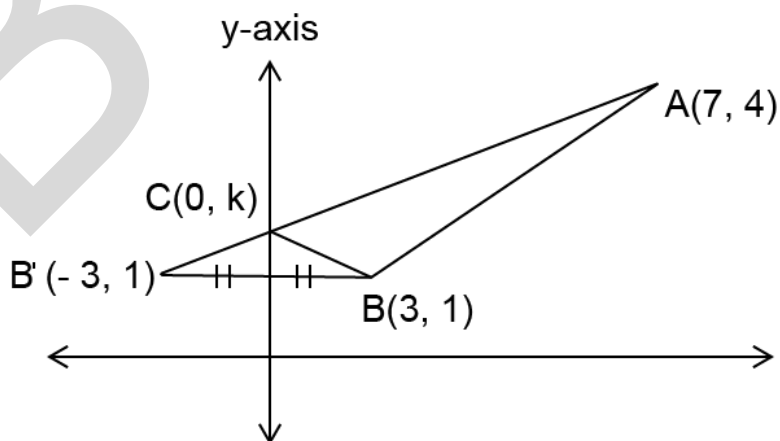
B' is reflection of B in y axis

B'C = BC

For AC + BC to be minimum A,C and B' should be collinear.

$$\frac{k-4}{0-7} = \frac{1-4}{-3-7}$$

$$\frac{k-4}{-7} = \frac{-3}{10}$$

$$k = \frac{19}{10}$$

Question 50. Two tangents PA and PB are drawn to a circle with centre O from an external point P. The chord AB intersects the line segment PO at Q. Then, the square of the radius of the circle is
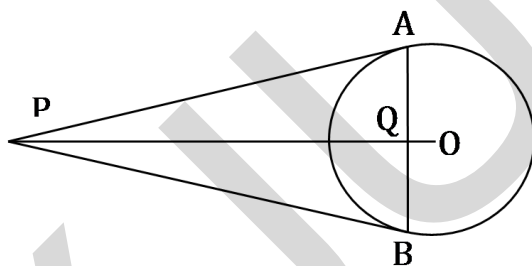
a. OQ × QP

b. OQ × OP

c. PQ × AB

d. PA × PB

Answer: (b)

Solution:
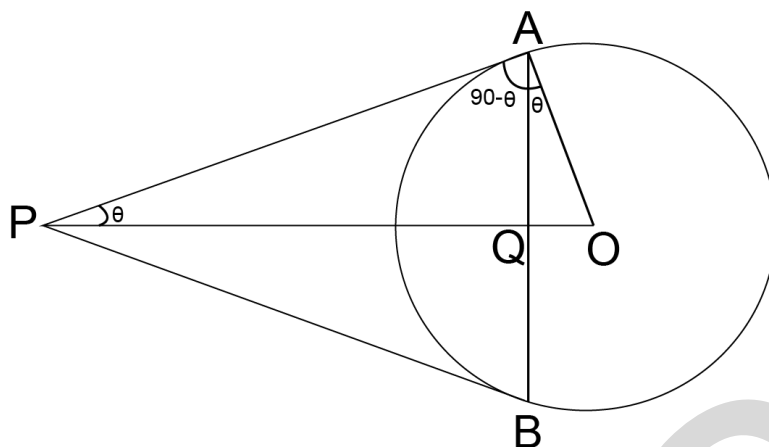
PAO ~ AQO

$$\frac{PA}{AQ} = \frac{AO}{QO} = \frac{PO}{AO}$$

AO x AO = PO x QO

$(r)^2 = (OP) \times (OQ)$

Question 51. In the given figure ABCD is a rectangle. Then the area of the shaded region is -
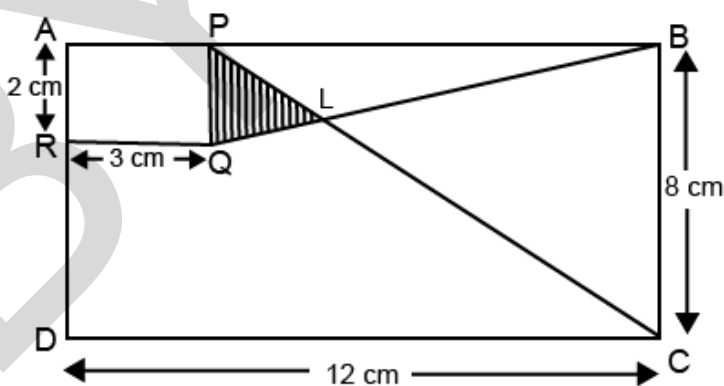
a. 1.2 sq. units

b. 1.4 sq. units

c. 1.6 sq. units

d. 1.8 sq. units

Answer: (d)

Solution:
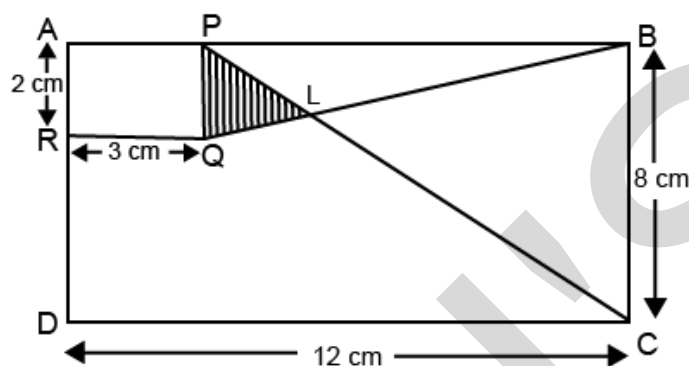
$\triangle$ PLQ ~ $\triangle$ CLB (AAA)

$\frac{Ar.(\Delta PLQ)}{Ar.(CLB)} = \left(\frac{PQ}{CB}\right) = \left(\frac{2}{8}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

$\Rightarrow Ar(\Delta PLQ) = \frac{1}{16} \times Ar(\Delta CLB)$

$\Rightarrow \frac{height(\Delta PLQ)}{height(\Delta BLC)} = \frac{1}{4}$

And sum of height of both triangle = 12 - 3 = 9

$\Rightarrow$ height($\triangle$ PLQ) = $\frac{1}{5} \times 9 = \frac{9}{5} cm$

Then the area of shaded region

$\Rightarrow$ Area($\triangle$ PLQ) = $\frac{1}{2} \times 2 \times \frac{9}{5} = \frac{9}{5} = 1.8 \ sq. \ units$

Question 52.In the given figure, ABC is an Isosceles triangle with AB = AC. If AE = AF and ∠BAE = 40°, then the measure of the angle FEC is
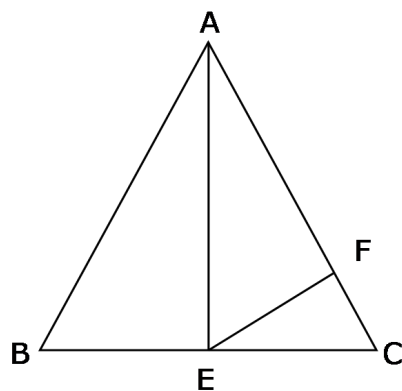
a. 15°

b. 20°

c. 40°

d. 60°

Answer: (b)

Solution:

$\Rightarrow$ 40° + 180° − 2y + x + x = 180°

       40° − 2y + 2x = 0

$\Rightarrow$ 2y − 2x = 40°

       Y − x = 20°

$\Rightarrow$ $\angle$FEC = y − x = 20°
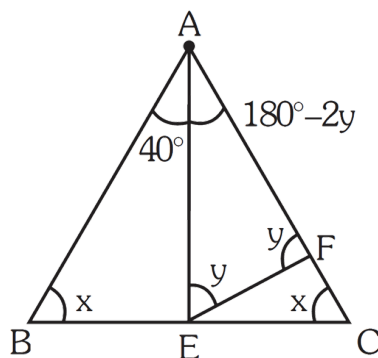
Question 53. In an equilateral $\triangle$ABC, side BC is produced to D and DF $\perp$ AB such that DF is intersecting AC at E. If BC = 2 CD and AF = 6cm, then the length (in cm) of BF is

a. 9

b. 12

c. 15
d. 18

Answer: (d)

Solution:
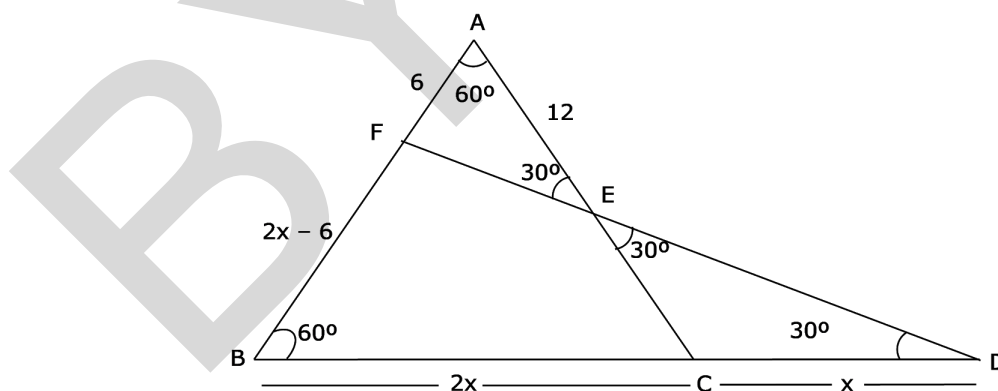
AB = BC = AC = 2x

in $\triangle$ AFE = $\angle$A = 60º

cos60º = $\frac{AF}{AE}$

$\frac{1}{2} = \frac{6}{AE}$

AE = 12

in $\triangle$ CDE

$\angle$D = 30º   (External angle property)

CD = CE = x

 AB = AC

2x = AE + EC

x = 12 cm

Length of BF = 2(12) – 6 = 18cm

Question 54.Water is flowing at the rate of 10 cm/minute through a pipe of diameter 10 cm into an empty bucket, which is in the form of frustum of a cone of height 30 cm with radii of its lower and upper ends as 10 cm and 20 cm respectively. Then, the time in which the level of water in the bucket will rise 15 cm, is

a. $\frac{\sqrt{17}}{10}$ minutes
b. $\frac{\sqrt{19}}{5}$ minutes
c. $\frac{\sqrt{17}}{5}$ minutes

d. $\frac{\sqrt{19}}{10}$ minutes

Answer: Bonus

Solution:
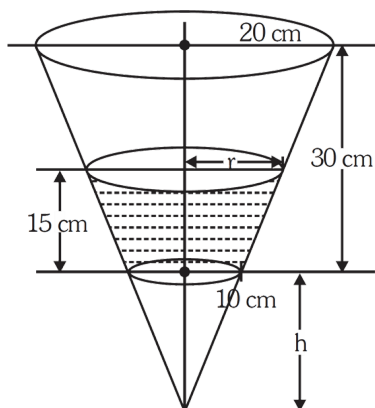
r = 5 cm

$$\frac{h}{h+15} = \frac{10}{r} \quad ...(1)$$

$$\frac{h}{h+30} = \frac{10}{20} \quad ...(2)$$

⇒ 20h = 10h + 300

⇒ 10h = 300

   h = 30

Now in eq. (1)

$$\frac{30}{45} = \frac{10}{r}$$

r = 15cm

Now, $\pi (5)^2 \times 10 \times t = \frac{1}{3}\pi \times 15(100 + 225 + 150)$

⇒ 250t = 5 × (475)

t = $\frac{5 \times 475}{250} = \frac{475}{50} = \frac{19}{2} minutes$

Question 55.The largest possible area of $\triangle$ABC with AB = 5m and the sum of other two sides as 7 cm

a. 5 $\sqrt{6}$ cm²

b. $\frac{5}{2}\sqrt{6}$ cm²

c. $\frac{5}{2}\sqrt{3}$ cm²

d. $5\sqrt{3}$ cm²

Answer: (b)

Solution:

AB = 5cm, BC + CA = 7cm
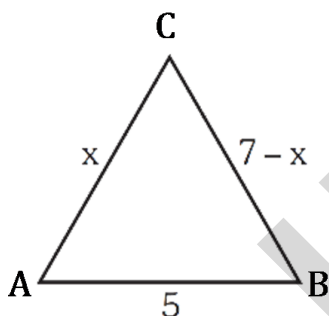
$S = \frac{5+7}{2} = 6$

$\Delta = \sqrt{6(6-5)(6-x)(6-7+x)}$

$\Delta = \sqrt{6 \times 1 \times (6-x)(x-1)}$

$\Delta = \sqrt{6(6-x)(x-1)}$

$\Delta = \sqrt{6(6x-6-x^2+x)}$

$\Delta = \sqrt{6(-x^2+7x-6)}$

As, $(-x^2+7x-6)_{max} = \frac{-49-4x(-1)\times(-6)}{4\times(-1)} = \frac{-(49-24)}{-4}$

$= \frac{25}{4}$

$\Rightarrow \Delta_{max} = \sqrt{6 \times \frac{25}{4}} = \frac{5}{2}\sqrt{6} cm^2$

Question 56.If u = cos θ (sin θ + $\sqrt{sin^2\theta + sin^2\alpha}$) then |u| is less than or equal to

a. $\sqrt{1 + sin^2\alpha}$

b. $\sqrt{1 + cos^2\alpha}$

c. $\sqrt{2 + sin^2\alpha}$

d. $\sqrt{2 + cos^2\alpha}$

Answer: (a)

Solution:

$u = cos\theta(sin\theta + \sqrt{sin^2\theta + sin^2\alpha})$

$u\ sec\ \theta = sin\ \theta + \sqrt{sin^2\theta + sin^2\alpha}$

$(u\ sec\ \theta - sin\ \theta)^2 = sin^2\ \theta + sin^2\ \alpha$

$u^2\ sec^2\ \theta + sin^2\ \theta - 2u\ tan\ \theta = sin^2\ \theta + sin^2\ \alpha$

$u^2(1 + tan^2\ \theta) - 2u\ tan\ \theta - sin^2\ \alpha = 0$

$u^2\ tan^2\ \theta - 2u\ tan\ \theta + u^2 - sin^2\ \alpha = 0$

$tan \in R$

$D \geq 0$

$(-2u)^2 - 4u^2(u^2 - sin^2\ \alpha) \geq 0$

$4u^2 - 4u^4 + 4u^2 sin^2\ \alpha \geq 0$

$u^2\ [u^2 - (1 + sin^2\ \alpha) \leq 0]$

As, $0 \leq u^2 \leq 1 + sin^2\ \alpha$

$\Rightarrow - \sqrt{1 + sin^2\alpha} \leq u \leq \sqrt{1 + sin^2\alpha}$

$\Rightarrow |u| \leq \sqrt{1 + sin^2\alpha}$

Question 57. Two straight roads OA and OB intersect at O. A tower is situated in the interior of the angle formed by them and subtends an angle of 45º and 30º at the points A and B respectively, where the roads are nearest to it. If OA = a and OB = b, then the height of the tower is

a. $\sqrt{\dfrac{a^2-b^2}{2}}$

b. $\sqrt{\dfrac{b^2-a^2}{2}}$

c. $\sqrt{\dfrac{3(b^2-a)^2}{2}}$

d. $\sqrt{\dfrac{3(a^2-b)^2}{2}}$

Answer: (a)

Solution:

In$\triangle$ PQA

$\cot 45° = \dfrac{PA}{n}$

$1 = \dfrac{PA}{n} \Rightarrow PA = n$

In Δ PQB

$\cot 30° = \dfrac{PB}{n}$

$\sqrt{3} = \dfrac{PB}{n}$

PB = n $\sqrt{3}$
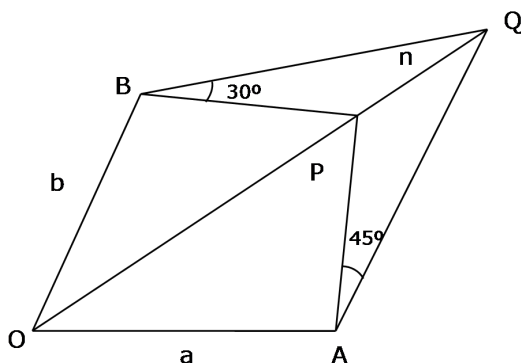
$(OP)^2 = (PA)^2 + (OA)^2$ ..... (1)

$(OP)^2 = (PB)^2 + (OB)^2$ ..... (2)

$(PA)^2 + (OA)^2 = (PB)^2 + (OB)^2$

$n^2 + a^2 = (n\sqrt{3})^2 + b^2$

$n^2 + a^2 = 3n^2 + b^2$

$-2n^2 = b^2 - a^2$

$h = \sqrt{\dfrac{a^2-b^2}{2}}$.

Question 58.ABCD is a square of side 8 cm, P is the midpoint of AD and is joined with vertex B. A perpendicular is drawn from the vertex C on BP, which intersects BP at point E. The area of the triangle BEC is.

a. $\dfrac{64}{5} cm^2$

b. $\dfrac{64}{\sqrt{5}} cm^2$

c. $\dfrac{32}{5} cm^2$

d. $\dfrac{32}{\sqrt{5}} cm^2$

Answer: (a)

Solution:
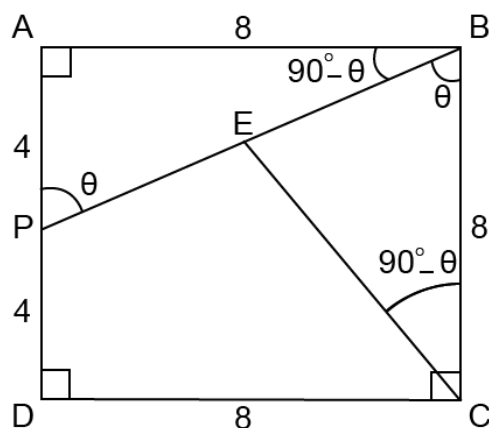
From pythagoras, $PB = 4\sqrt{5}$

$\triangle ABP \sim \triangle ECB$ (AAA)

$\Rightarrow \frac{AB}{EC} = \frac{BP}{CB} = \frac{AP}{EB}$

$\Rightarrow \frac{8}{EC} = \frac{4\sqrt{5}}{8} = \frac{4}{EB}$

$\Rightarrow EB = \frac{8}{\sqrt{5}}$ and $EC = \frac{16}{\sqrt{5}}$

Now, Area($\triangle BEC$) $= \frac{1}{2} \times BE \times EC = \frac{1}{2} \times \frac{8}{\sqrt{5}} \times \frac{16}{\sqrt{5}}$

$\Rightarrow \frac{64}{5} cm^2$

Question 59.The mean of three numbers is 10 more than the least number and 15 less than the greatest number. If the median of three numbers is 5, then the sum of squares of these numbers is

a. 625

b. 650

c. 675

d. 725

Answer: (b)

Solution:

$\frac{a+b+c}{3} = 10 + a = c - 15$

b = 5 [mean = m]

a = m − 10

c = m + 15

m − 10 + 5 + m + 15 = 3m

m = 10

a = 10 − 10 = 0

c = 10 + 15 = 25

Required Sum = $0^2 + 5^2 + (25)^2$

= 25 + 625

= 650

Question 60. A and B are two metallic solid spheres such that the surface area of B is 800% more than that of A. If the volume of A is x% less than that of B, then the value of x is closest to

a. 64.2

b. 72.4

c. 95.5

d. 96.3

Answer: (d)

Solution:

Let a and b be the radius of solid sphere A and B

800% more means 9 times

$$\frac{Surface\ area\ of\ solid\ sphere\ B}{Surface\ area\ of\ solid\ sphere\ A} = \frac{9}{1}$$

$$\frac{b}{a} = \frac{3}{1}$$

$$\frac{Volume\ of\ solid\ sphere\ A}{Volume\ of\ solid\ sphere\ B} = \left(\frac{3}{1}\right)^3 = \frac{27}{1}$$

% of volume less

$$= \frac{27-1}{27} \times 100$$

96.3 % (approx)

SOCIAL

Question 61. Which of the following statements regarding the position and role of women during the French Revolution are correct?

I. Olympe de Gouges was a supporter of ' The Declaration of Rights of Man and Citizen'.
II. Women were disappointed that the Constitution of 1791 reduced them to passive citizens.
III. The Revolutionary Government made education compulsory for girls, marriage was made into a contract and divorce was made legal.
III. The Revolutionary Government finally recognized women's struggle for equal Political Rights and gave them the right to vote.
a. I and II
b. I and IV
c. II and III
d. III and IV

Answer: (c)

Solution:

'The Declaration of Right of Man and Citizen' was a civil document that granted rights like liberty, property, security and resistance to oppression to only men in France as a

result of the French Revolution of 1789. Olympe de Gouges was a French political activist who advocated for the right of women. The French Constitution of 1791 reduced women to passive citizens' status, which treated them as illiterate citizens unqualified to vote and participate in decision-making. However, the French Revolutionary government of 1792 established reforms for women like education, marriage and divorce rights.

Question 62. Which of the following statements about socialism are correct ?

I. Robert Owen was the founder of New Harmony.
II.Louis Blanc wanted Government supported co-operatives.
III. Marx argued that all property should be socially controlled
IV.Robert Owen also believed that workers should construct a radically socialist society.
a. I, II and III
b. I, II and IV
c. I, III and IV
d. II, III, IV

Answer: (a)

Solution:

New Harmony was a town located in Indiana, founded by a group of 800 Pietists from Württemburg, Germany in order to propagate ideas based on spiritual well being. Robert Owen, a social reformer reorganised the New Harmony in 1825 and conducted social experiments to establish an utopian socialist society that emphasised the rights of workers.
Louis Blanc was a French socialist, historian and politician. He wanted government supported co-operatives which could guarantee the urban poor with employment.
Karl Marx was a radical socialist who argued that all property should be socially controlled.

Question 63. Which of the following statements about Maasais are correct ?

I. Maasais are found in Tanzania and Kenya.
II.Samburu National Park is situated in Tanzania.
III. The title Maasai is derived from the word 'maa', which means 'my land'.

IV. Maasai land was taken away by not only British Kenya, but also German Tanganyika.
a. I and II
b. I and IV
c. I, II and III
d. II, III and IV

Answer: (b)

Solution:

Maasais are nomadic pastoralists of East Africa. "Maa" refers to the speakers of the Eastern Sudanic language of the Nilo-Saharan language family. They are found in Tanzania and Kenya.
Maasai land was taken away by not only British Kenya, but also German Tanganyika. Samburu National Park is situated in Kenya.

Question 64. With regard to Polo, identify correct statements from the following.

I. Polo was a game of European origin.
II. Sultan Qutubuddin Aibak died while playing Polo.
III. Polo was suitable for military and athletic young men.
a. Only II is true
b. Both I and II are true, but III is false
c. Both I and III are true, but II is false
d. Both II and III are true, but I is false

Answer: (d)

Solution:

Polo originated in Persia, today's Iran, between 6th century BC and the first century AD. Polo was a training sport designed to support the skills of the king's guard or elite troops. The game was exclusively designed for military and athletic men. Sultan Qutubuddin Aibak died while he was playing Polo in 1290.

Question 65. With regard to women clothing after World War in Europe; identify the correct statements from the ones given below.
I. Wars eroded distinctions among women in Europe.

II. World War I shortened women's clothes for practical necessity.

III. New schools encouraged luxurious dressing and ornamentation.

a. Only I is true

b. I and II are true but III is false

c. II and III are true but I is false

d. I and III are true but II is false

Answer: (b)

Solution:

Most nations taking part in the World War, saw limited changes in the gender norms in their respective societies. Women were being celebrated as representatives of domesticity. Distinctions among women eroded at this time. They took up several jobs such as nurses, female military auxiliaries, ambulance drivers, farm workers, factory labourers etc to support their nations' military efforts. Women's fashion also underwent change. Victorian era women's clothing were shortened for practical necessity. Luxurious dressing and ornamentation were discouraged. Most of the resources were diverted towards the soldiers and war efforts.

Question 66. In the light of political developments that took place in the first quarter of twentieth century India, match the following:

Place	Event	Year
I. Amritsar	A. Mill workers Strike	i. 1916
II. Kheda	B. Rowlatt Act	ii. 1917
III. Ahmedabad	C. Peasant Strike	iii. 1918
IV. Champaran	D. Plantation Workers Strike	iv. 1919
	E. Khilafat movement	v. 1920

a. I-B-iv, II-C-ii, III-A-iii, IV-D-i

b. I-E-ii, II-B-iv, III-A-iii, IV-D-v

c. I-D-iv, II-C-ii, III-A-iii, IV-B-i

d. I-C-ii, II-B-iv, III-A-iii, IV-E-i

Answer: (a)

Solution:

Place	Event	Year
I. Amritsar	B. Rowlatt Act	iv. 1919
II. Kheda	C. Peasant Strike	ii. 1917
III. Ahmedabad	A. Mill workers Strike	iii. 1918
IV. Champaran	D. Plantation Workers Strike	i. 1916

Question 67. A history excursion of your school involved a visit to four countries. It first went to a city which had a treaty signed in early nineteenth century approving of 'new conservatism'. It then travelled to the former kingdom of Sardinia-Piedmont, followed by a visit to the country one ruled by the 'Hohenzollern dynasty' and finally reaching a city where many feel sowed the seeds of Nazism and the Second World War were sown.
The correct sequence of the countries visited would be :

a. Austria – Italy – Germany and France
b. Germany – Italy – Austria and France
c. France – Germany – Italy and Austria
d. Austria – Italy – France and Germany

Answer: (a)

Solution:

The correct sequence of the countries visited should look like this.
Austria-Italy-Germany-France.

The Treaty of Vienna was signed in Austria in 1815. This treaty gave way to new conservatism. The kingdom of Sardinia-Piedmont was a part of modern day Italy. Germany was ruled by the 'Hohenzollern dynasty'. The Treaty of Versailles was signed in France in 1919. It sowed the seeds of Nazism, which would ultimately lead to the Second World War.

Question 68. Nationalism in India which emerged as a force in the late nineteenth century meant strong devotion for

a. All countries of the world
b. One's own country, its history and culture
c. One's own country and hatred towards others.
d. One's own country without appreciation of other nations

Answer: (b)

Solution:

Nationalism in India emerged as a result of the British imperialist policies that exploited the country's resources and people. The exploitation by the British was not limited to political and economical aspects alone. It extended to erase India's culture and historical significance. Hence Indian nationalism in the late nineteenth century proclaimed independence and the right to enjoy its history and culture.

Question 69. Which of the following provides the most appropriate sequence of events in the context of the French revolution ?

a. Increase in population – scarcity of grains-rising food prices – inability of the poor to buy bread – food riots
b. Scarcity of grains – increase in population – rising food prices – inability of the poor to buy bread-food riots
c. Food riots – scarcity of grains – bad harvest – rising food prices – inability of the poor to buy bread
d. Increases in population – rising food prices – scarcity of grains – food riots – inability of the poor to buy bread.

Answer: (a)

Solution:

There was an increase in the population of France. At the same time, the French society saw an increase in the price of food, as there was scarcity of grains. This made the poor people unable to buy bread, which in turn caused resentment among the common masses. This resentment coupled with the extravagance of the aristocracy led to the food riots and ultimately the French Revolution.

Question 70. Imagine yourself as a Kulak during Stalin's Collectivisation programme. Which of the following would you have excluded from your objection(s) to Collectivisation ?
I. Support to socialism.
II. Independent cultivation
III. Work in collective farms
IV. Transfer of land to collective farms

a. I and II only
b. I and IV only
c. II and III only
d. III and IV only

Answer: Bonus

Solution:

Only I is correct
Kulak refers to the peasant class in Soviet Russia who owned more than eight acres of land. The Collectivisation Programme was launched as a part of the Five Year Plan introduced by Joseph Stalin in 1928 that made efforts to improve industrialisation and collectivise agriculture in the USSR. Under the collectivisation programme, individuals were encouraged to transfer their lands to the state and work in collective farms managed and regulated by the state. Kulaks opposed this program. So, statements II, III, and IV are to be present in the objection list.

Directions : (Questions 71-75)

Read the statements and select the correct answer from the options given below.

a. Statement-I is true, Statement-II is false

b. Statement-I is False, Statement-II is true

c. Both Statement are True and Statement-II provides explanation to Statement-I

d. Both Statements are True and Statement-II does not provide explanation to Statement-I

Question 71. Statement-I : During the Civil Disobedience Movement, 'no rent' campaign were carried out in most places.

Statement-II : The relationship between the poor peasants and the Congress remained uncertain.

Answer: (d)

Solution:

The 'no rent' campaign was launched by Bal Gangadhar Tilak as a result of the 1896 famine in India seeking peasants not to pay rent to their landlords. However, the Congress did not support the 'no rent' campaigns in order to not risk their relationship with the landlords. Therefore, the support of Congress did not rest with the interests of poor peasants and hence their relationship remained uncertain during then.

Question 72. Statement-I : Mahatma Gandhi successfully organized the Satyagraha movement of 1916 and 1917 in favour of peasant.

Statement-II : In Champaran, Gandhi Ji inspired the middle class to struggle against the oppressive plantation system and in Kheda district of Gujarat he supported their demand for relaxation in revenue collection affected by crop failure.

Answer: (a)

Solution:

Mahatma Gandhi organised two satyagrahas, one in Champaran, Bihar and the other in Kheda, Gujarat between 1916 and 1917 in favor of peasants. The two satyagrahas were in support of peasants who demanded relaxation in revenue collection from the British due to crop failure and plague epidemic.

Question 73. Statement-I : Khadar soils are poor in organic matter yet these soils are very fertile.

Statement-II : Khadar soils are fertile because they fall in the flood plain zone of the river.

Answer: (c)

Solution:

Khadar is the newer alluvium, deposited by floods annually. They fall in the floodplain zone of the river, renewed almost every year. These are fertile soil which comprise of mud, silt, clay and sand and suitable for the cultivation of sugarcane, oilseeds, wheat, maize and rice.

Question 74. Statement-I : Indian citizens have the right to freedom.

Statement-II : Indian citizens have the freedom to criticize the core values of the Constitution.

Answer: (d)

Solution:

Article 19 of the Indian constitution, allows the citizens of India the right to freedom of speech and expression. The scope of the right to freedom also includes the right to criticize the core values of the Constitution.

Question 75.Statement-I : Some form of social grouping has to be expressed in politics through gender division.

Statement-II : The Panchayati Raj Act was enacted to have a fair proportion of women in the local bodies.

Answer: (c)

Solution:

To ensure larger participation of women in politics, social grouping based on gender is necessary. Among other goals, providing reservation of one third of the total number of seats and offices for women was one of the main objectives of the Panchayati Raj Act.

Question 76. In India, there are landlocked states as well as states with long coastlines. Madhavan is planning to travel from Srinagar to Kanyakumari. What is

the minimum number of landlocked and coastal states that he would have to traverse excluding the origin and destination UTs/States ?

a. 3, 2
b. 3, 3
c. 2, 2
d. 2, 3

Answer: BONUS

Solution:
While travelling from Srinagar to Kanyakumari, one will have to traverse a minimum three landlocked and three coastal states
3 coastal states- Tamil nadu, Karnataka. Maharashtra.
3 landlocked states- Madhya pradesh, Rajasthan, Punjab. Considering Jammu & Kashmir as union territory.

Question 77. Geological structure, physiography and precipitation regimes influence evolution of drainage patterns. India with it's diversity in the above mentioned attributes show cases a variety of drainage patterns across regions. Match the following drainage patterns found in the region given below

a. A-III, B-IV, C-V, D-II
b. A-IV, B-II, C-V, D-III
c. A-III, B-IV, C-I, D-II
d. A-V, B-III, C-I, D-IV

Answer: Bonus

Solution: Question incomplete

Question 78. Colonialism has been so far defined in terms of political, economic and social changes brought in the colonies. The aspect related to changes bringing in the biodiversity of the colonies has received little attention. One such practice was the introduction of new species of trees by the colonizers in the colonies. Identify two trees that were introduced by colonizers in India.

I. Birch

II. Teak

III. Chir Pine

IV. Rhododendron

a. I and II

b. II and III

c. II and IV

d. III and IV

Answer: (b)

Solution:

Colonization brought about various changes in the Indian subcontinent, especially in terms of political, economic and social changes. They also changed the face of forests and forestry in India. This scenario was true for most of the colonies. New species of plants and animals were also introduced. Teak and Chir Pine were introduced in India by the British to fulfill the demands of wood in the European mainland.

Question 79. Indian farmers adopt diverse farming practices in different environmental conditions in order to maximize the yield. Identify the type of farming where the second crop is seeded even before the harvesting of the previous standing crop.

a. Inter cropping
b. Mixed cropping
c. Relay cropping
d. Multiple cropping

Answer: (c)

Solution:

Relay cropping is a variant of double cropping. The second crop is planted before the harvest of the first crop. Thus, both crops share some part of the season. Small farmers can increase their crop productivity and net return per unit area which allows them to make efficient utilisation of their resources. In India, Rice –cauliflower – onion-summer gourd is one example of relay cropping.

Question 80. During the South-West monsoon season, India receives the maximum amount of rainfall. However, it varies from place to place. Choose the correct

sequence of regions arranged in descending order of rainfall received from South West Monsoon.

a. Khasi Hills, Western Ghats, Bengal Delta
b. Western Ghats, Khasi Hills, Bengal Delta
c. Bengal Delta, Khasi Hills, Western Ghats
d. Bengal Delta, Western Ghats, Khasi Hills

Answer: (a)

Solution:

During the South-West monsoon season, the Garo and Khasi hills of Meghalaya receives the highest rainfall. Mawsynram in the Khasi Hills of Meghalaya receives rainfall over 1,080 cm in a year. Western Ghat too receives rainfall from the South-West monsoon ranging from 250 cm to 400 cm. Though the Bengal delta receives rainfall during the South-West monsoon season, the amount of rainfall is less compared to the other two regions.

Question 81. Different types of soils are found in India having special characteristic features. One of these extends approximately between 13 degree N to 25 degree N latitudes and 72 degree E to 82 degree E longitudes. Identify the soil type from the given options.

a. Red soil
b. Black soil
c. Laterite soil
d. Red and Yellow soil

Answer: (b)

Solution:

The deccan plateau region is located approximately between 13 degree N to 25 degree N latitudes and 72 degree E to 82 degree E longitudes. This region has Black soil or Regur soil. This type of soil is favourable for cotton cultivation.

Question 82. Samanwita is taking her friends from Gandhinagar to her Grand Parents' home located in Kolkata. They board the flight from Gandhinagar and fly

over Bhopal and Ranchi to reach Kolkata. Which of the following statements are true regarding their travel?

I. Travelled over saline soils, badlands, calcareous soil and alluvial soils.
II. Flew across Vindhyas, Bundelkhand, Chotanagpur plateau and Rahr regions.
III. Almost traversed along the Tropic of Cancer.
IV. Crossed rivers Chambal, Son and Damodar on the way.

a. I and II
b. I and IV
c. II and III
d. III and IV

Answer: (d)

Solution:

In the mentioned case, the flight from Gandhinagar to Kolkata is most likely to fly over the Tropic of Cancer. Moreover, the passengers will cross the rivers Chambal, Son and Damodar on the way, while crossing the states of Madhya Pradesh, Jharkhand and West Bengal.

Question 83. The Western Ghats and Eastern Ghats are marked by many differences in terms of geographical aspects. Which of the following statements are true about the Eastern and Western Ghats?

I. Western Ghats are more continuous than Eastern Ghats.

II. Cardamom Hills, Javadi Hills, Shevaroy Hills and Nallamalai Hills are part of Eastern Ghats.

III. Western Ghats have higher elevation than Eastern Ghats.

IV. Doda Betta and Mahendragiri are the highest peaks of Western and Eastern Ghats respectively.

a. I and II only
b. II and III only
c. II and IV only
d. III and IV only

Answer: BONUS

Solution:
Cardamom Hills are a part of Western Ghats. Anaimudi is the highest peak of the Western Ghats at 2,695 metres above sea level.

Question 84. Himalayas are the young mountains originated from the sedimentary deposits of the Tethys Sea due to collision of continental plates. The process has remained active over millions of years resulting into a series of almost parallel ranges of different heights. Identify the Himalayan and Trans-Himalayan ranges from their cross-section given below.

a.   A = Karakoram; B=Zaskar: C=Ladakh; D=Himadri.
b.   A=Zaskar; B=Karakoram; C=Himadri; D=Ladakh.
c.   A=Karakoram; B=Ladakh; C=Zaskar; D=Himadri.
d.   A=Zaskar; B=Himadri; C=Ladakh; D=Karakoram

Answer: (c)

Solution:

In the given cross-sectional view of the Himalayas, A,B,C and D represents Karakoram, Ladakh, Zaskar and Himadri respectively. The Karakoram, Ladakh, Zaskar ranges are located north to the Great Himalayas. Towards their south is the Great or Inner Himalayas, also known as the 'Himadri.

Question 85. Rivers are an important element of the physical landscape of India. Variations in the environmental factors have resulted in the evolution of diverse drainage systems. Which of the following statements is/are incorrect about the drainage system of India?
I. The Beas flows into Pakistan and joins Sutlej.
II. Sutlej and Indus are examples of antecedent drainage.
III. River Luni drains into Sambar Lake which is an example of inland drainage.
IV. The rivers flowing from the western slopes of Western Ghats are swift and have a short course.

a. I and III

b. I, II and III

c. II and III

d. II, III and IV

Answer: (a)

Solution:

Other than the statement I and III, all the statements are true. The Beas rises at Rohtang Pass in Himachal Pradesh and joins the river Sutlej at Harike in Punjab. The saline river Luni drains into the Rann of Kutch in Gujarat, flowing through Rajasthan.

Question 86. Understanding the spatio-temporal aspects of population is one of the main concerns of demographers. They have tried to measure the aspects of the same by selecting certain key indicators. Match the indicators listed in column I with the explanations given in column II

	Column I		Column II
A.	Density of population	I	Increase or decrease in population.
B.	Population Growth	II	Number of people in a given area.
C.	Natural Growth	III	Man-Land ratio.
D.	Distribution of population	IV	Birth Rate minus Death Rate
		V	In migration minus Out Migration

a. A-II, B-V, C-I, D-III

b. A-III, B-IV, C-I, D-II

c. A-III, B-I, C-IV, D-II

d. A-II, B-IV, C-III, D-V

Answer: (c)

Solution:

	Column I		Column II
A	Density of population	I	Man-Land ratio.
B	Population Growth	II	Increase or decrease in population.
C	Natural Growth	III	Birth Rate minus Death Rate
D	Distribution of population	IV	Number of people in a given area.

Question 87.Federalism is the most popular form of democratic governance today. With reference to a federal political system, which of the following does NOT hold true?

a. Spain, Pakistan and South Africa examples of a federal system.
b. Holding together federations always give equal power to its constituent units.
c. The jurisdiction and authority of each tier of government is constitutionally mandated.
d. For a dispute relating to division of powers it is the High Courts and Supreme Court of India which interpret the Constitution

Answer: (b)

Solution:

All the statements other than (b) are true. In a federal form of government, both state and union governments operate simultaneously. But, that does not always mean the equal division of powers between the two.

Question 88. Regular elections are the backbone of democracy. Arrange the following election related activities in a correct sequence.
A. Announcement of election schedule.
B. Election Campaign.
C. Making of vorter's list.
D. Polling of votes
E. Counting of votes.

F. Announcement of election results and issue of press note.

Which of the following indicates the correct sequence of activities?

a. C, D, F, E, B, A

b. F, C, A, B, D, E

c. A, B, C, E, D, F

d. C, A, B, D, E, F

Answer: (d)

Solution:

Elections provide us the opportunity to express our opinions. It is a lengthy process, involving many activities. It starts with preparation of voters list by election commission. EC also announces the election schedule and then political parties start their election campaign. It is followed by the polling of vote & counting and finally the announcement of election results.

Question 89. The Constitution of India was drafted by a group of elected representatives called the Constituent Assembly. With reference to the above, the members of the Constituent Assembly from the Provinces were_____ _.

a. Directly elected by the people of those Provinces.

b. Elected by the Provincial Legislative Assemblies.

c. Nominated by the India National Congress and the Muslim League.

d. Nominated by the Government for their expertise on constitutional matters.

Answer: (b)

Solution:

The members of the Constituent Assembly from the Provinces were elected by the Provincial Legislative Assemblies. 292 members of the total 389 were elected through the Provincial Legislative Assemblies.

Question 90. Consider the following statements about the Rule of Law :
I. Everybody shall be ruled by law as decided by the judiciary.
II. No man shall be punished except for clear breach of law.
III. Everybody except persons holding constitutional positions like the President and the Election Commissioner shall be subjected to law.

IV. The term 'Rule of Law' was coined by F.A. Hayek. Which of the above statement/s is/are correct ?

a. I, II and III
b. I, II and IV
c. II, III and IV
d. II only

Answer: (d)

Solution:

The rule of law was expounded by Dicey in 1885, although it had been used earlier by Sir Edward Coke formally. It refers to the mechanism, process, institutions, practices, or norms that supports all citizens' equality before the law, secures a non arbitrary form of government. Thus, represents the idea that no man shall be punished except for clear breach of law. The rule of law is not absolute in nature and certain people and groups of people are given discretionary powers. For example, public servants, ministers, military, lawyers etc.

Question 91. Consider the following statements about the process of Amendment in the Constitution of India :
I. An amendment to the Constitution of India can be initiated by introduction of a bill in the Lok Sabha only.
II. If such an amendment seeks to make changes in the federal character of the Constitution, the amendment needs to be ratified by the legislature of all the States of India.
Which of the above statement/s given above is/are correct ?

a. I only
b. II only
c. Both I and II
d. Neither I nor II

Answer: (d)

Solution:

Amendment to the Constitution of India can be initiated by either of the houses i.e Lok Sabha and Rajya Sabha. If such an amendment seeks to make changes to the

federal character of the Constitution, the amendment needs to be ratified by at least 50% of the legislature of the states.

Question 92. The Constitution of India provides for division of power between the Union and the States enumerated in three lists. Based on the division of subjects in the lists, identify the ones which are correctly matched.

I. Citizenship and extradition - Union List
II. Public health and sanitation - State list
III. Forest and trade - Concurrent list
IV. Computer software and digital

privacy -State list

Choose the correct option :

a. I and II
b. I, II and III
c. I, III and IV
d. I, II, III and IV

Answer: (b)

Solution:

The schedule VII of the Indian constitution provides three lists of subjects i.e. Union List, State list and Concurrent list. There are also a few subjects which are not included in the lists called residuary subjects. Computer software and digital privacy is a residuary subject. Other than option IV, all others are correctly matched.

Question 93. In a social science class, the teacher asked the students to give their opinion about ensuring food security in India. Opinions given by Pahi, Saju, Zara and Veda are given below. Whose opinion is NOT suitable for achieving food security ?

a. **Saju :** Provide subsidy for export of food grains.
b.   **Pahi :** Increase food grain production in our country.
c. **Veda :** Penalise the persons who waste food grains in our country.
d. **Zara :** Provide free food grains to all people below poverty line in our country.

Answer: (a)

Solution:

Food security is a principle which emphasises on the availability, affordability and accessibility of food to all the people in a country. Ensuring food security may involve increasing the production of foodgrains in the country and establishing means to provide foodgrains to people who are in need. Food wastage shall be prevented through measures like penalisation. Export of foodgrains affects the availability of food within the country. Therefore, export should be focussed only after ensuring self sustenance in the country.

Question 94. Inexpensive Chinese locks, are flooding the Indian markets, thus destroying the traditional lock industry of India. Which of the following methods can the Government of India take up to protect the Indian lock industry?
I. Revalue Indian Currency.
II. Give subsidy on the import of Chinese lock.
III. Impose import tax on the import of Chinese lock.
IV. Place limit on the number of goods that can be imported.

a. I and III
b. I and IV
c. II and IV
d. III and IV

Answer: (d)

Solution:

In order to protect the industries of its own nation, the government needs to impose import taxes on goods imported from abroad. It is also important to place a limit on the number of imports.
Revaluation of the Indian currency is not a good option here as it may lead to trade imbalances.
Subsidising the import of Chinese locks would act as an incentive. It would lead to decline in the sale of Indian clocks.

Question 95. Of the 200 households in the village of Chandanwadi, 100 households are debtors. They have borrowed money from the following sources.

Sources of Credit	No. of Households
Landlords	22
Bank of India	5
Farmer's cooperative bank	15
Money lenders	18
Bank of Allahabad	10
Friends and relatives	15
Maharashtra State Cooperative Bank	15

Based on the table given above which of the following statements are correct?

I. Formal sources of credit are lower than informal sources.

II. Informal sources of credit are lower than formal sources.

III. One-fifth of debtors borrowed from friends and relatives.

IV. Money lenders and landlords continue to be major sources of credit in the village.

a. I and III

b. I and IV

c. II and III

d. III and IV

Answer: (b)

Solution:

There are 100 debtors in total. Out of them, 55 (22+18+15) debtors rely on informal sources of credit. Informal sources of credit include landlords, money lenders and friends and relatives. Whereas, 45 (5+15+10+15) debtors went to banks and other financial institutions to avail credit. Thus, money lenders and landlords continue to be major sources of credit in the village.

Question 96. Dhanno gets up in the morning and milks her cow. She sells milk to three houses. She then cooks food for her family, and prepares her children for school. At 10 a.m., she goes to the market with vegetables from her garden and sells it. By 11.30 a.m. she goes to Simranjeet's house and cooks food for Simranjeet's family. At 2.00 p.m. she goes to Harpreet's house and washes clothes. By 5.00 pm she goes home and washes her family's clothes.

Identify the economic activities performed by Dhanno.

I. Getting her children ready for school

II. Cooking food for her family

III. Cooking for Simranjeet's family

IV. Washing her family's clothes

V. Washing Harpreet's clothes

VI. Selling vegetables

VII. Selling milk

a. I, III, IV and VI

b. II, V, VI and VII

c. I, II, III and V

d. III, V, VI and VII

Answer: (d)

Solution:

Activities performed for the family or self are not recognised as economic activities. Hence, when Dhanno gets her children ready for school, cooks food for her family and washes her family's clothes, they are not considered as economic activities.

On the other hand, when she cooks at Simranjeet's house, washes Harpreet's clothes, sells vegetables and milk, they are considered as economic activities. These activities also bring in revenue for Dhanno.

Question 97. Himmatveer has inherited land and Rs. 2,50,000 from his father. He decided to build a factory on the land. He spent Rs. 2,00,000 for the building. To

purchase the machines he took a loan of Rs. 75,000 from the bank and purchased machines. After six months, he could start production. He used the rest of the money that he has inherited to purchase the raw materials required. His fixed capital and the working respectively are :

a. Rs. 2,00,000 and Rs. 50,000

b. Rs. 2,75,000 and Rs. 50,000

c. Rs. 50,000 and Rs. 2,00,000

d. Rs, 50,000 and Rs. 2,75,000

Answer: (b)

Solution:

Fixed capital is the long term assets of a business. Working capital is the current assets of a business. In the case of Himmatveer fixed capital amounts to Rs. 275000, where Rs. 200000 is the amount spent on the building and Rs. 75000 is the amount taken from the bank as a loan to purchase machines. His working capital amounts to Rs. 50000 from his father which he used to purchase raw materials.

Question 98. Based on the given table, arrange the following households in the order of the most poor to the least poor.

Name of Head of House hold	Location of residence	Daily wage	No. of work days per person	Size of the house hold	No. of working members
Jeewan	Mumbai	100	15	7	2
Yashwant	Palampur Village	80	25	3	3
Sheelam	Bangalore	100	25	4	3
Sumer	Dindori Village	100	15	6	2

a. Yashwant, Sumer, Sheelam, Jeewan
b. Sheelam, Yashwant, Jeewan, Sumer
c. Jeewan, Sumer, Sheelam, Yashwant
d. Sumer, Sheelam, Yashwant, Jeewan

Answer: (c)

Solution:

Average income is used to determine poverty here.
The average family income can be calculated as
(Daily Wage*No. of working days*No. of working members)/Size of the household

Jeewan= (100*15*2)/7= 428.75
Sumer= (100*15*2)/6= 500
Sheelam= (100*25*3)/4= 1875
Yashwant= (80*25*3)/3= 2000

Question 99. The following data are given according to the Economic Survey 2012-13.

	Life Expectancy at birth (2006-10) (in years)	Infant Mortality rate (2011) (Per 1000 Live births)	Death Rate (Per 1000)
Odisha	63.0	57	8.5
Rajasthan	66.5	52	6.7
West Bengal	69.0	32	6.2
Maharashtra	69..9	25	6.3

Which alternative shows the states with descending order of health indicators ?
a. Maharashtra, West Bengal, Rajasthan, Odisha
b. Maharashtra, West Bengal, Odisha, Rajasthan
c. West Bengal, Maharashtra, Rajasthan, Odisha

d. Odisha, Maharashtra, West Bengal, Rajasthan

Answer: (a)

Solution:

Maharashtra displays the best health indicators among Odisha, Rajasthan and West Bengal from the data mentioned. High life expectancy at birth, low infant mortality rate and low death rates are good health indicators.

Question 100. Economic tools and their relevant objectives are as follows :

Tools :	A. Issue Price
	B. Minimum Support Price
Objectives:	I. To create more buffer stock
	II. To reduce malnutrition in India
	III. To encourage farmers to produce more food grains
	IV. To distribute food grains in deficit areas and among poor families

Which alternatives gives correct combination of tools and their objectives :

a. A – I and II, B – III and IV

b. A – II and IV, B – I and III

c. A – I and III, B – II and IV

d. A – I and II, B – II and IV

Answer: (b)

Solution:

Minimum Support Price or MSP is a type of government intervention. It is made to insure the farmers against a steep fall in the prices of their crops to aid them against losses in a year of surplus production. When the market price drops below the

declared MSP, the government ought to purchase the entire quantity at the set MSP from the farmers.

Public distribution systems or ration shops sell goods such as wheat, rice, sugar at a price lower than the market price. This is known as the Issue Price. Other essential commodities are also sold at relatively low prices. In order to avail this service, one must be a ration card holder.

Tools	Objectives
Issue Price	To reduce malnutrition in India
	To distribute food grains in deficit areas and among poor families
Minimum Support Price	To create more buffer stock
	To encourage farmers to produce more food grains