SEAL

Test Booklet Number	Subject Code : **1901**	Roll Number
00652	**MATHEMATICS AND SCIENCE**	

Time : 2 Hours] [*Maximum Marks* : 300

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you answer the questions given in this Test Booklet :

1. Answers to questions in this Test Booklet are to be given on an **OMR Answer Sheet** provided to the candidate **separately**.
2. Candidate must fill up Name, Category, Test Booklet Number, Subject Code and Roll Number in the Answer Sheet carefully as per instructions given.
3. This Test Booklet consists of 75 questions. All questions are compulsory and carry equal marks.
4. Each question in this Test Booklet has four possible alternative answers namely, (A), (B), (C) and (D), one of which is correct. Candidate should choose the correct answer against each question out of four alternative answers.
5. Candidate is instructed to answer the questions by **darkening** (●) with **Ballpoint Pen** only in the circle bearing the correct answer.
6. Candidate should not attempt more than one answer in each question. More than one attempt in any form against a question shall be treated as incorrect.
7. Marking of answer other than darkening shall be cancelled and darkening should remain within the circle otherwise computer shall not accept during evaluation of Answer Sheet.
8. Rough work must not be done on the Answer Sheet. Use the blank spaces given in the Test Booklet for rough work.
9. Candidate is to hand over the Answer Sheet to the Invigilator before leaving the Examination Hall.
10. **NEGATIVE MARKING** : Each question carries 4 (four) marks for correct response. For each incorrect response, 1 (one) mark will be deducted from the total score. More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.

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MATHEMATICS

1. A number when divided by 143 leaves 31 as remainder. What will be the remainder when the same number is divided by 13?

(A) 0 (B) 1

(C) 3 (D) 5

2. If one factor of $y^4 + y^2 - 20$ is $y^2 + 5$, then the other factor is

(A) $y^2 - 2$ (B) $y^2 - 4$

(C) $y^2 + 4$ (D) $y - 4$

3. It is given that the difference between zeroes of $4x^2 - 8kx + 9$ is 4 and $k > 0$, then the value of k is

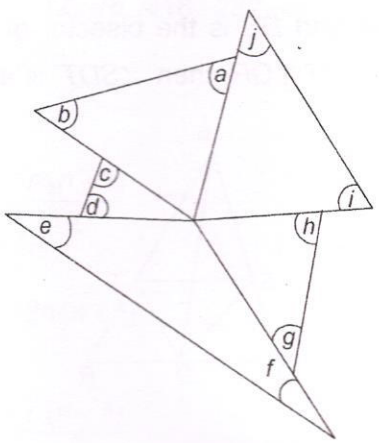
(A) $\frac{1}{2}$ (B) $\frac{3}{2}$

(C) $\frac{5}{2}$ (D) $\frac{7}{2}$

4. In the given figure, the measure of

$a + b + c + d + e + f + g + h + i + j$

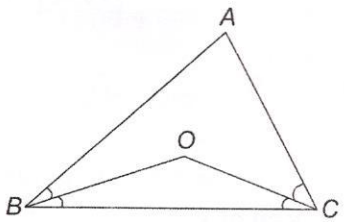
is



(A) 900° (B) 720°

(C) 540° (D) 360°

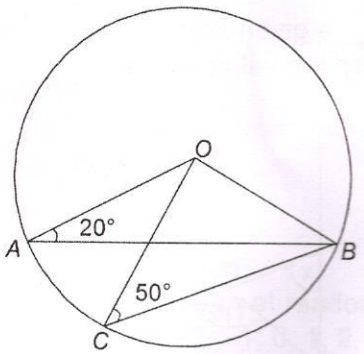
5. In the given figure, $AB > AC$. If BO and CO are bisectors of $\angle B$ and $\angle C$ respectively, then



(A) $OB = OC$ (B) $OB > OC$

(C) $OB < OC$ (D) $OB < 2OC$

6. In the given figure, O is center of a circle in which $\angle OAB = 20°$ and $\angle OCB = 50°$, then $\angle AOC$ is



(A) 50° (B) 70°

(C) 60° (D) 20°

7. The adjacent sides of a parallelogram are 8 cm and 9 cm. The diagonal joining the ends of these sides is of length 13 cm. The area of parallelogram is

(A) 72 cm^2 (B) $12\sqrt{35}$ cm^2

(C) $6\sqrt{35}$ cm^2 (D) $24\sqrt{35}$ cm^2

8. A rectangular paper of length 8 cm and breadth 5 cm is rolled to form a cylinder of height equal to the breadth of the paper. Its base radius is

(A) $\frac{8}{\pi}$ cm (B) $\frac{3}{4}\pi$ cm

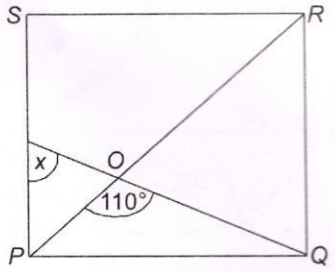
(C) $\frac{4}{\pi}$ cm (D) $\frac{9}{2\pi}$ cm

9. The mean of x, $x+3$, $x+5$, $x+7$ and $x+10$ is 9. The mean of the last three observations is

(A) $10\frac{1}{3}$ (B) $10\frac{2}{3}$

(C) $11\frac{1}{3}$ (D) $11\frac{2}{3}$

10. In the given figure, $PQRS$ is a square, then the value of x is



(A) 60° (B) 110°

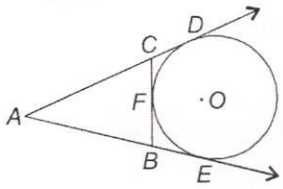
(C) 70° (D) 65°

11. In what ratio does x-axis divide the join of $A(2, -3)$ and $B(5, 6)$?

(A) 2 : 3 (B) 3 : 5

(C) 1 : 2 (D) 2 : 1

12. In the given figure AD, AE and BC are tangents to the circle with center O, touching it at D, E and F respectively then



(A) $AD = AB + BC + CA$

(B) $2AD = AB + BC + CA$

(C) $3AD = AB + BC + CA$

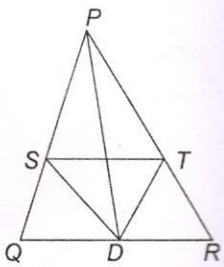
(D) $\frac{1}{2}AD = AB + BC + CA$

13. The sum of the digits of a two-digit number is 9. If 27 is added to it, the digits are reversed. The number is

(A) 25 (B) 72

(C) 63 (D) 36

14. In the given figure, D is the mid-point of QR and DS is the bisector of $\angle PDQ$ and $ST \parallel QR$, then $\angle SDT$ is equal to



(A) 45° (B) 90°

(C) 60° (D) 30°

15. If $\cos 9\alpha = \sin \alpha$ and $9\alpha < 90°$, then the value of $\tan 5\alpha$ is

(A) $\frac{1}{\sqrt{3}}$

(B) $\sqrt{3}$

(C) 1

(D) 0

16. If $\sin\theta$ and $\cos\theta$ are roots of the equation $ax^2 + bx + c = 0$, then the value of $a^2 + 2ac - b^2$ is

(A) 1

(B) –1

(C) $\frac{1}{2}$

(D) 0

17. The sum of n terms of the AP

$$\sqrt{2}, \sqrt{8}, \sqrt{18}, \sqrt{32}, \cdots$$

is

(A) $\frac{n(n+1)}{2}$

(B) $2n(n+1)$

(C) $\frac{n(n+1)}{\sqrt{2}}$

(D) 1

18. Two circles touch internally. The sum of their areas is 116π cm^2 and the distance between their centers is 6 cm. Radii of the circles are

(A) 6 cm and 4 cm

(B) 8 cm and 4 cm

(C) 10 cm and 6 cm

(D) 10 cm and 4 cm

19. A hemispherical bowl is made of steel of thickness 0·25 cm. The inner radius of the bowl is 5 cm. The volume of steel used (in cm^3) is [use $\pi = 3{\cdot}14$]

(A) 42·15

(B) 41·52

(C) 41·25

(D) 42·25

20. A number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. The probability that $|x| < 2$ is

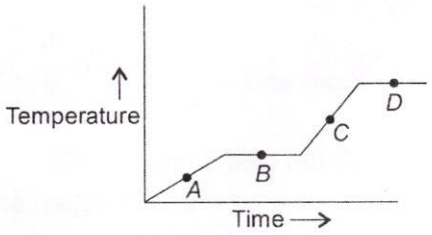
(A) $\frac{5}{7}$

(B) $\frac{2}{7}$

(C) $\frac{3}{7}$

(D) $\frac{1}{7}$

21. The given temperature-time graph shows the heating curve for pure substance.



The physical state of the substances *B* and *D* respectively be

(A) coexist in solid and liquid at point *B* and in liquid and vapour at point *D*

(B) solid at *B*, gaseous at *D*

(C) liquid at *B* and gaseous at *D*

(D) coexist in solid and liquid at point *D* and liquid and gas at point *B*

22. Which one of the following statements with respect to liquefaction of gases is correct?

(A) High pressure brings the particles of a gas close and high temperature takes the particles apart. Balance between the two liquifies gas.

(B) High pressure brings the particles of a gas close and low temperature also brings them close, so the gas liquifies.

(C) Low pressure brings the particles of a gas close and low temperature also brings them close, so the gas liquifies.

(D) Low pressure brings the particles of a gas close and high temperature takes them apart. Balance between the two liquifies gas.

23. In a laboratory, the students were given the task of preparing a 40% (mass by volume) solution of sodium chloride (NaCl) in water. Which one of the following will give the desired solution?

(A) 4 g of sodium chloride dissolved in water to make 100 ml of the solution

(B) 4 g of sodium chloride dissolved in 100 g water

(C) 40 g of sodium chloride dissolved in 100 ml of water

(D) 40 g of sodium chloride dissolved in water to make 100 ml of solution

24. 6 g of glucose (molar mass—180 g mol^{-1}) is dissolved in 18 g of water in a beaker. The number of oxygen atoms in the solution is

(A) $7{\cdot}015 \times 10^{23}$

(B) $7{\cdot}105 \times 10^{21}$

(C) $7{\cdot}105 \times 10^{23}$

(D) $7{\cdot}015 \times 10^{21}$

25. Which of the following has maximum number of atoms?

(A) 18 g of H_2O

(B) 18 g of O_2

(C) 18 g of CO_2

(D) 18 g of CH_4

26. The number of electrons in an element X is 92 and the numbers of neutrons is 143. Which of the following is the correct representation of element X?

(A) $^{92}_{51}X$

(B) $^{235}_{92}X$

(C) $^{143}_{92}X$

(D) $^{143}_{51}X$

27. Which one of the following is a feasible reaction?

(A) $Cu(s)+MgSO_4(aq) \rightarrow Mg(s)+CuSO_4(aq)$

(B) $Mg(s)+Na_2SO_4(aq) \rightarrow 2Na(s)+MgSO_4(aq)$

(C) $Zn(s)+2AgNO_3(aq) \rightarrow 2Ag(s)+Zn(NO_3)_2(aq)$

(D) $Ba(s)+K_2SO_4(aq) \rightarrow 2K(s)+BaSO_4(aq)$

28. Consider the reactions given below :

1. $Zn(s)+CuSO_4(aq) \rightarrow ZnSO_4(aq)+Cu(s)$

2. $Cu(s)+2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq)+2Ag(s)$

3. $Fe(s)+CuSO_4(aq) \rightarrow FeSO_4(aq)+Cu(s)$

4. $Zn(s)+FeSO_4(aq) \rightarrow ZnSO_4(aq)+Fe(s)$

What is the correct increasing order of the reactivity of metals?

(A) Cu < Ag < Fe < Zn

(B) Ag < Cu < Zn < Fe

(C) Ag < Cu < Fe < Zn

(D) Fe < Zn < Ag < Cu

29. Salts of strong acid and weak base and those of strong base and strong acid respectively have their pH values

(A) less than seven and more than seven

(B) more than seven and less than seven

(C) equal to seven and more than seven

(D) less than seven and equal to seven

30. Consider the following statements about the gas which evolves when acetic acid is added to sodium hydrogen carbonate?

1. It has a pungent smell.
2. It turns limewater milky.
3. It extinguishes a burning splinter.
4. It burns with a pop sound.
5. It dissolves in a solution of sodium hydroxide.

The correct statements are

(A) 1, 2 and 4

(B) 2 and 5

(C) 2, 3 and 5

(D) 1, 3 and 5

31. A metal *M* is found in nature as its sulphide *X*. On heating in air *X* converts into its oxide *Y* and a gas evolves. On heating *X* and *Y* together, the metal *M* is obtained. *X* and *Y* respectively are

(A) *X* = calcium sulphide; *Y* = calcium oxide

(B) *X* = sodium sulphide; *Y* = sodium oxide

(C) *X* = cupric sulphide; *Y* = cupric oxide

(D) *X* = cuprous sulphide; *Y* = cuprous oxide

32. Which of the following metals is/are obtained by electrolysis of their chlorides in molten state?

1. Cu
2. Al
3. Na
4. Ca

(A) 2 only

(B) 3 only

(C) 1 and 3

(D) 3 and 4

33. In the compound CH_3Cl, carbon attains the electronic configuration of

(A) helium

(B) neon

(C) argon

(D) krypton

34. An organic compound has a molecular formula C_2H_6O. It does not change the colour of the litmus paper, but forms gas bubbles on being treated with sodium metal. This compound is

(A) acetaldehyde

(B) dimethyl ether

(C) ethyl alcohol

(D) methyl alcohol

35. A small portion of the modern periodic table is given below in which elements are represented by English alphabets :

Period	*Groups*					
	1	2	.....	13	14	15
1	A					
2	B	C		D	E	F
3				G		

Which one of the following decreasing orders of atomic radii is correct?

(A) G > E > D > C

(B) G > D > C > E

(C) E > D > C > G

(D) G > C > D > E

36. Among the elements having atomic numbers 2, 4, 8, 10, 12, 14, 16, 18 and 20. Which one of the following is a group of elements of valency two?

(A) 4, 8, 12

(B) 4, 10, 20

(C) 4, 12, 20

(D) 4, 14, 20

37. Consider the following statements regarding endoplasmic reticulum :

1. It can be the site of energy generation.
2. It can be the site for some biochemical activities of the cell.
3. It transports materials between various regions in cytoplasm.
4. It behaves as a transport channel for proteins between nucleus and cytoplasm.

The correct statements are

(A) 1, 2 and 3

(B) 2 and 3

(C) 3 and 4

(D) 2, 3 and 4

38. Which of the following options are the functions of endoplasmic reticulum?

1. To help in the manufacture of protein molecules.
2. To help in the manufacture of energy currency.
3. To help in detoxifying many poisons and drugs.
4. To help in the storage, modification and packaging of products in vesicles.

(A) 1 and 2

(B) 1 and 3

(C) 3 and 4

(D) 2 and 4

39. In humans, the unstriated, uninucleate muscles are present in

(A) the walls of the heart

(B) limbs

(C) the walls of alimentary canal

(D) liver

40. In an accident, two long bones of a person are dislocated. The possible reason of dislocation may be breaking of

(A) skeletal muscles

(B) tendons

(C) smooth muscles

(D) ligaments

41. Choose the function of the pancreatic juice from the following :

(A) Trypsin digests proteins and lipase digests carbohydrates

(B) Trypsin digests emulsified fats and lipase digests proteins

(C) Trypsin and lipase digest fats

(D) Trypsin digests proteins and lipase digests emulsified fats

42. Algae differ from fungi in being

(A) heterotrophic

(B) epiphytic

(C) parasitic

(D) autotrophic

43. Pancreas secretes pancreatic juice which contains more than one enzymes. These enzymes are

(A) pepsin and tripsin

(B) tripsin and lipase

(C) lipase and amylase

(D) amylase and pepsin

44. A student performed the following experiment on photosynthesis. He took soda water in a glass tumbler and added chlorophyll extract from freshly crushed green leaves into the tumbler and kept the tumbler exposed to sunlight hoping that he provided all the necessary ingredients for photosynthesis to proceed (namely CO_2, water, chlorophyll and light). What do you think will happen after, say 5 hours of exposure to sunlight?

(A) Photosynthesis will take place and starch will be produced which will turn the mixture turbid

(B) Photosynthesis will take place and glucose will be produced and the mixture will become sweet

(C) Photosynthesis will not take place because CO_2 dissolved in soda water escapes into the atmosphere

(D) Photosynthesis will not take place because intact chloroplasts and other conditions needed for the process are not available

45. The rate of breathing in aquatic animals is much faster in comparison to the terrestrial animals because

(A) aquatic animals have very low metabolic rate

(B) the amount of dissolved oxygen in water is low in comparison to that in air

(C) amount of dissolved CO_2 is high in water in comparison to that in air

(D) it is quite cool in water in comparison to air

46. Many of the involuntary actions in the human body are controlled by

(A) midbrain and medulla in the forebrain

(B) forebrain and medulla in the hindbrain

(C) hindbrain and medulla in the forebrain

(D) midbrain and medulla in the hindbrain

47. The timing and the amount of hormones released in humans is regulated by

(A) reflex action

(B) control and coordination

(C) feedback mechanism

(D) external stimuli

48. Which among the following statements are true for unisexual flowers?

1. They exhibit self-pollination.
2. They possess either stamen or pistil.
3. They exhibit cross-pollination.
4. Unisexual flowers possessing only stamen cannot produce fruits.

(A) 1 and 4

(B) 2, 3 and 4

(C) 3 and 4

(D) 1, 2 and 4

49. Which among the following are the functions of testes at puberty?

1. Secretion of testosterone
2. Secretion of estrogen
3. Development of placenta
4. Formation of gametes (germ-cells)

(A) 1 and 4

(B) 2 and 3

(C) 1, 2 and 3

(D) 1, 3 and 4

50. A list of analogous and homologous organs in animals is given below :

1. Wings of a bird and wings of a bat
2. Hindlimb of a frog and that of a human
3. Wings of birds and that of butterflies
4. Flippers of a whale and wings of a bird

Analogous organs in the above list are

(A) 1 and 2

(B) 1 and 3

(C) 1 and 4

(D) only 1

51. A tall pea plant (TT) is crossed with a dwarf pea plants (tt). All F_1 plants shaved tall phenotype. Which one of the following correctly defines a test-cross?

(A) (Tt) × (Tt)

(B) (TT) × (Tt)

(C) (Tt) × (tt)

(D) (tt) × (Tt)

52. The velocity of a moving object at $t = 0$ is 16 ms^{-1}. If the object slows down at an acceleration of $-0{\cdot}5$ ms^{-2}, the displacement of the object at $t = 4$ s would be

(A) 60 m

(B) 196 m

(C) 256 m

(D) 512 m

53. A motorcyclist drives from A to B with a uniform speed of 30 kmh^{-1} and returns back with a speed of 20 kmh^{-1}. The average speed of the motion is

(A) 24 kmh^{-1}

(B) 25 kmh^{-1}

(C) 26 kmh^{-1}

(D) 27 kmh^{-1}

54. A bus of mass M and a car of mass m are moving side by side on a highway with the same velocity v. Drivers of both vehicles apply brakes simultaneously on seeing a checkpost at a distance s. If both the vehicles are brought to rest in same time and if $M > m$, then they will have same

(A) initial momentum

(B) rate of change of momentum

(C) retardation force applied by their engines

(D) deceleration while they come to stop

55. An object dropped on the surface of the Earth takes a time of 50 s to fall a certain height h. If the same object is dropped on the surface of a planet whose mass and radius are twice that of the Earth, how long would the object take to fall through the same height?

(A) 100 s

(B) $50\sqrt{2}$ s

(C) 50 s

(D) $\frac{50}{\sqrt{2}}$ s

56. A beaker partially filled with a liquid is put on a platform balance which is then set to zero. An object of mass 750 g is fully immersed in the liquid filled in the beaker using a spring balance. If the spring balance now reads 150 g, the reading on the platform balance would be

(A) zero

(B) 150 g

(C) 600 g

(D) 750 g

57. An object of mass m moving along a straight path with a velocity u collides with a heavier mass M and gets embedded into it. If the compound system keeps moving in the same direction, then select the correct statement from the following :

(A) Kinetic energy before the collision = kinetic energy after the collision

(B) The kinetic energy after collision is $\frac{1}{2}\left(\frac{M^2+m^2}{M+m}\right)u^2$

(C) There will be a loss of kinetic energy equal to $\frac{1}{2}\frac{m^2u^2}{(M+m)}$

(D) There will be a loss of kinetic energy equal to $\frac{1}{2}\frac{Mm}{(M+m)}u^2$

58. A car of mass 1 metric tonne is moving on a level road with a speed of 10 ms^{-1}. If the speed of the car is increased to 20 ms^{-1} the work done by the engine of the car (neglecting frictional forces) would be

(A) 400 kJ

(B) 300 kJ

(C) 200 kJ

(D) 150 kJ

59. A person clapped his hands near a cliff and heard the echo after 3 s. The distance of the cliff from the person is (speed of sound in air is 342 ms^{-1})

(A) 171 m

(B) 513 m

(C) 684 m

(D) 1026 m

60. A parallel beam of light converges at a distance 10 cm infront of a concave mirror. The position of the object to get an image of same size as that of object will be

(A) 15 cm, infront of the mirror

(B) 10 cm, infront of the mirror

(C) infinity, infront of the mirror

(D) 20 cm, infront of the mirror

61. An object of height 6 cm is placed at a distance of 60 cm infront of a concave lens of focal length 30 cm. Which one of the following sets gives the correct values of the image distance (v) and the height of the image (h') formed by the lens?

(A) $v = -20$ cm; $h' = -2$ cm

(B) $v = -30$ cm; $h' = -3$ cm

(C) $v = -30$ cm; $h' = +3$ cm

(D) $v = -20$ cm; $h' = +2$ cm

62. Refractive indices of water, sulphuric acid, glass and carbon disulphide are 1·33, 1·43, 1·53 and 1·63 respectively. The decreasing order of speed of light in there media would be

(A) water > sulphuric acid > glass > carbon disulphide

(B) carbon disulphide > glass > sulphuric acid > water

(C) water > carbon disulphide > sulphuric acid > glass

(D) water > sulphuric acid > carbon disulphide > glass

63. A person with defective vision needs to stand at a distance of 40 cm from a notice board to see distinctly an important information posted on it. A person with normal vision can see it distinctly from a distance of 2·0 m. Which one of the following lenses may be used in his spectacles to correct the defective vision of the person?

(A) A convex lens of power 2·0 D

(B) A concave lens of power 2·0 D

(C) A concave lens of power 1·0 D

(D) A concave lens of power 0·5 D

64. The phenomenon which is responsible for Tyndall effect and blue colour of clear sky is

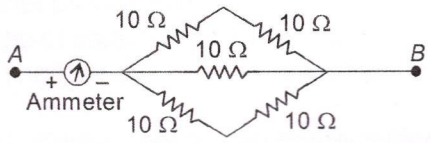
(A) refraction of light

(B) dispersion of light

(C) scattering of light

(D) reflection of light

65. Five resistors of 10 Ω each are connected between *A* and *B* as shown. If the potential difference between *A* and *B* is 10 V, the ammeter reading would be



(A) 0·2 A

(B) 0·5 A

(C) 1·0 A

(D) 2·0 A

66. A hot plate of an electric oven connected to 220 V line has two resistance coils *A* and *B*, each of resistance 24 Ω, current flowing through coils is found to be I_1, I_2 and I_3 when used separately, in series and in parallel respectively. Which of the following is correct?

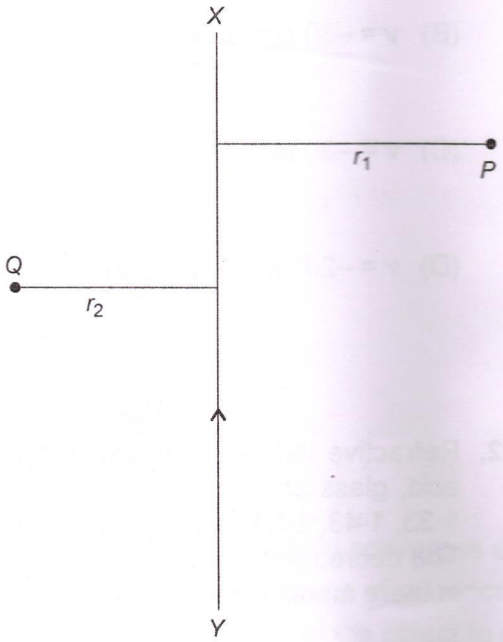
(A) $I_1 > I_2 > I_3$

(B) $I_1 < I_2 < I_3$

(C) $I_3 > I_1 > I_2$

(D) $I_1 > I_3 > I_2$

67. A current carrying conductor *XY* is kept in the plane of paper as shown in the figure. *P* and *Q* are two points at distance r_1 and r_2 $(r_1 > r_2)$ from the straight conductor. The magnetic field at these points be B_P and B_Q respectively, which of the following is true?



(A) B_P is vertically inward, B_Q is vertically outward and $B_P > B_Q$

(B) B_P is vertically outward, B_Q is vertically inward and $B_P < B_Q$

(C) B_P is vertically inward, B_Q is vertically outward and $B_P < B_Q$

(D) B_P is vertically outward, B_Q is vertically inward and $B_P > B_Q$

68. The disease caused by protozoan is

(A) Dengue fever

(B) Kala-azar

(C) Acne

(D) Typhoid

69. Which among the following is a set of sexually transmitted disease (STD)?

(A) Gonorrhea, Hepatitis, Syphilis

(B) Hepatitis, HIV/AIDS, Syphilis

(C) HIV/AIDS, Gonorrhea, Syphilis

(D) Gonorrhea, HIV/AIDS, Hepatitis

70. In planets such as Mars and Venus, where no life is known to exist, the amount of carbon dioxide (CO_2) in the atmosphere is close to

(A) 50%

(B) 66%

(C) 87%

(D) 96%

71. Consider the following statements :

1. Cross between plants of two species is called as inter-varietal hybridisation.

2. Introducing new genes of desired character into a plant gives genetically modified (GM) crop.

3. Cross between two varieties is called inter-specific hybridisation.

4. Crossing between genetically dissimilar varieties of a plant is termed as hybridisation.

The correct statement(s) is/are

(A) 2 only

(B) 1 and 2 only

(C) 2 and 4 only

(D) 2, 3 and 4

72. The long lactation period cattles are

(A) Jersey and Brown Swiss

(B) Red Sindhi and Sahiwal

(C) Jersey and Red Sindhi

(D) Brown Swiss and Sahiwal

73. The best form of energy which leads to least environmental pollution in the process of harnessing and utilization globally is

(A) thermal energy

(B) geothermal energy

(C) solar energy

(D) nuclear energy

74. Consider the following food chain :

Grass $\rightarrow$ Grasshopper $\rightarrow$ Frog $\rightarrow$ Snake $\rightarrow$ Hawk

Suppose in this food chain amount of energy available to hawk is 10 kJ, the energy available to grasshopper is

(A) 10^5 kJ

(B) 10^4 kJ

(C) 10^3 kJ

(D) 40 kJ

75. The pH of water collected from a river was found to be in the range of 3·5–4·5. It was observed that on the banks of the river several factories were discharging untreated effluents into it. The effluents of which factory are the most likely cause for this range of pH of the river water?

(A) Plastic cup manufacturing factory

(B) Soap manufacturing factory

(C) Alcohol distillery

(D) Lead battery manufacturing factory

SPACE FOR ROUGH WORK

SEAL

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