

Test Booklet Number

Subject Code : 2001

Roll Number

00599

**MATHEMATICS AND
SCIENCE**

Time : 2 Hours]

[Maximum Marks : 300

INSTRUCTIONS FOR 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 space 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.

MATHEMATICS

1. The sum of two natural numbers is 216 and their HCF is 27. How many pair(s) of such numbers is/are there?

(A) 4

(B) 1

(C) 3

(D) 2

2. If $\frac{x}{y} + \frac{y}{x} = -1$ ($x \neq 0, y \neq 0$), then the value of $x^3 - y^3$ is

(A) -1

(B) 2

(C) 0

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

3. If α, β are the zeroes of the polynomial $x^2 - 7x + 12$, then the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ is

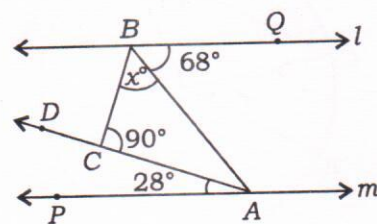
(A) $\frac{12}{25}$

(B) $\frac{25}{12}$

(C) $\frac{49}{12}$

(D) $\frac{12}{49}$

4. In the given figure $l \parallel m$ and $BC \perp AD$. If $\angle QBA = 68^\circ$ and $\angle CAP = 28^\circ$, then the value of x is



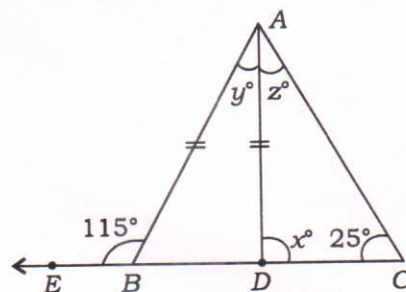
(A) 40°

(B) 78°

(C) 50°

(D) 22°

5. In the given figure, the side CB of $\triangle ABC$ is produced to E, such that $\angle EBA = 115^\circ$ and $\angle BCA = 25^\circ$. D is any point on BC, such that $\angle ADC = x^\circ$, $\angle BAD = y^\circ$ and $\angle DAC = z^\circ$. If $AB = AD$, then $(x + y + z)^\circ$ is equal to



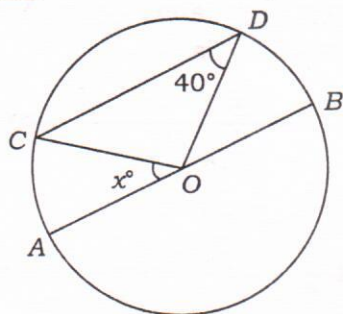
(A) 180°

(B) 205°

(C) 360°

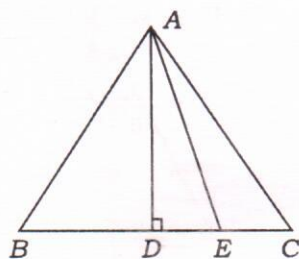
(D) 90°

6. In the given figure, $CD \parallel AB$, where AB is a diameter. If $\angle CDO = 40^\circ$, then x° equals



- (A) 80°
(B) 40°
(C) 30°
(D) 20°

7. In the given figure, $2BE = 3EC$ and $\text{ar}(\triangle ABC) = 35 \text{ cm}^2$, then $\text{ar}(\triangle AEC)$ is



- (A) 54 cm^2
(B) 24 cm^2
(C) 27 cm^2
(D) 14 cm^2

8. A sphere of radius r is placed inside a closed right circular cylinder, so as to touch the top, base and lateral surface of the cylinder. The volume of cylinder is

- (A) $4\pi r^3$
(B) $\frac{8}{3}\pi r^3$
(C) $2\pi r^3$
(D) $8\pi r^3$

9. The probability that in a family of 3 children, there will be at least one boy, is

- (A) $\frac{1}{8}$
(B) $\frac{7}{8}$
(C) $\frac{6}{8}$
(D) $\frac{4}{8}$

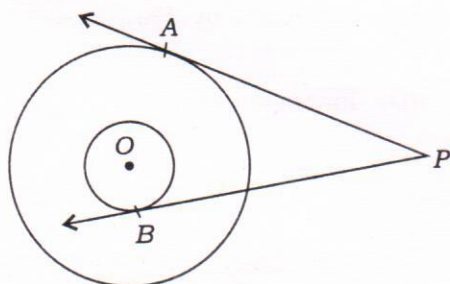
10. In a rhombus $ABCD$, $\angle A = 60^\circ$ and $AB = 10 \text{ cm}$. The length of diagonal BD is

- (A) $2\sqrt{5} \text{ cm}$
(B) 20 cm
(C) 10 cm
(D) Insufficient data

11. If $(0, 0)$ and $(3, \sqrt{3})$ are two vertices of an equilateral triangle, then the third vertex is

(A) $(0, 2\sqrt{3})$ or $(3, -\sqrt{3})$
 (B) $(0, -2\sqrt{3})$ or $(3, -\sqrt{3})$
 (C) $(0, 2\sqrt{3})$ or $(-3, \sqrt{3})$
 (D) $(0, 2\sqrt{3})$ or $(-3, -\sqrt{3})$

12. In the given figure, O is the centre of two concentric circles of radii 5 cm and 3 cm respectively. PA and PB are tangents to the circles from P . If $PA = 12$ cm, then PB is equal to

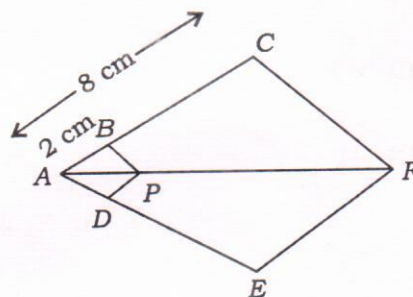


(A) $5\sqrt{2}$ cm
 (B) $3\sqrt{5}$ cm
 (C) $4\sqrt{10}$ cm
 (D) $5\sqrt{10}$ cm

13. If 3 chairs and 1 table cost ₹ 900 and 5 chairs and 3 tables cost ₹ 2,100, then the cost of 5 chairs and 1 table is equal to

(A) ₹ 1,000
 (B) ₹ 1,100
 (C) ₹ 1,200
 (D) ₹ 1,300

14. In the given figure, $PB \parallel CF$ and $PD \parallel EF$, then $\frac{AD}{DE}$ equals



(A) $\frac{3}{4}$
 (B) $\frac{1}{3}$
 (C) $\frac{1}{4}$
 (D) $\frac{2}{3}$

15. If $\cos A + \cos^2 A = 1$, then $\sin^2 A + \sin^4 A$ equals

(A) -1

(B) 0

(C) 1

(D) ± 1

16. If a and b are roots of the quadratic equation $x^2 + ax + b = 0$, then $a + b$ equals

(A) 1

(B) 2

(C) -2

(D) -1

17. The measures of the interior angles of a convex polygon are in AP. If the smallest angle is 100° and the largest angle is 140° , then the number of sides of the polygon is

(A) 6

(B) 8

(C) 10

(D) 11

18. The area of a sector of a circle of radius 16 cm cut off by an arc, which is 18.5 cm long, is

(A) 168 cm^2

(B) 154 cm^2

(C) 176 cm^2

(D) 148 cm^2

19. If the height of a right circular cylinder is increased by 10% and the radius of the base is decreased by 10%, then curved surface area of the cylinder

(A) remains same

(B) decreases by 1%

(C) increases by 1%

(D) increases by 0.1%

20. The probability of getting 53 Saturdays in a randomly selected leap year is

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

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

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

(D) $\frac{4}{7}$

SCIENCE

21. Which one of the following statements is **correct** about liquefaction of atmospheric air?

- (A) High pressure brings the particles of air close together and low temperature also brings them close, hence the air liquefies.
- (B) High pressure brings the particles of air close together and high temperature takes the particles apart, hence a balance is made to liquefy air.
- (C) Low pressure brings the air particles close together and low temperature also brings them close, hence the air liquefies.
- (D) Low pressure brings the air particles close together and high temperature takes them apart, hence a balance is made to liquefy air.

22. Oxygen, argon and nitrogen are separated from liquid air by fractional distillation. Boiling points of these gases are -183°C , -186°C and -196°C respectively. The correct order in which these gases are obtained is

- (A) argon, oxygen and nitrogen
- (B) nitrogen, argon and oxygen
- (C) oxygen, nitrogen and argon
- (D) oxygen, argon and nitrogen

23. Consider the following :

- 1. Starch solution
- 2. Copper sulphate solution
- 3. Milk
- 4. A solution of glucose dissolved in water
- 5. Shaving cream

The Tyndall effect will be exhibited by

- (A) 1, 2 and 3
- (B) 2 and 5 only
- (C) 1, 3 and 5
- (D) 2 and 3 only

24. The number of nitrogen atoms present in 280 g of nitrogen gas is

- (A) 6.022×10^{24}
- (B) 6.022×10^{25}
- (C) 1.2044×10^{25}
- (D) 1.2044×10^{26}

25. Consider the following statements in the course of a chemical reaction :

1. Overall mass of substances remains constant.
2. Molecules of substances entering into a reaction survive.
3. Atoms of substances entering into a reaction survive.
4. The overall number of atoms before the reaction equals that after the reaction.

The **correct** statements are—

- (A) 1 and 3 only
- (B) 3 and 4 only
- (C) 1, 2 and 3
- (D) 1, 3 and 4

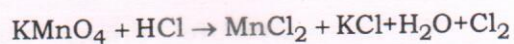
26. The ion of an element M is represented as M^{3+} . Mass number of M is 27 and the number of neutrons in its nucleus is 14. What is the number of electrons in the ion M^{3+} ?

- (A) 16
- (B) 14
- (C) 13
- (D) 10

27. The products of decomposition of lead nitrate on heating are

- (A) Pb_3O_4 , NO_2 and O_2
- (B) PbO , NO_2 and O_2
- (C) Pb_3O_4 , NO and O_2
- (D) PbO , NO and O_2

28. Consider the following skeletal chemical equation :



The sum of the coefficients in the RHS of the above reaction equation when balanced, is equal to

- (A) 4
- (B) 8
- (C) 17
- (D) 18

29. The turmeric solution is an indicator which turns reddish brown when an unknown solution is added to it. This may be an aqueous solution of which one of the following chemical compounds?

- (A) Copper sulphate
- (B) Ferric chloride
- (C) Potassium acetate
- (D) Sodium sulphate

30. Which one of the following is the **correct** decreasing order of pH value (in their aqueous solutions)?

- (A) Sodium acetate > sodium chloride > acetic acid > nitric acid
- (B) Sodium chloride > sodium acetate > acetic acid > nitric acid
- (C) Sodium acetate > sodium chloride > nitric acid > acetic acid
- (D) Sodium acetate > acetic acid > sodium chloride > nitric acid

31. Characteristics of a metal *M* are given below :

1. Its oxide reacts with acid and alkali both.
2. *M* reacts with hydrochloric acid to form metal chloride.
3. *M* does not react with water at room temperature or on heating.
4. *M* reacts with steam to form metal oxide and hydrogen gas is evolved.

The metal *M* is

- (A) calcium
- (B) sodium
- (C) aluminium
- (D) iron

32. An element *A* reacts with water to form *B*, which is used in whitewashing. *B* on heating forms *C* which on treatment with water gives *B* back.

A, *B* and *C* respectively are

- (A) calcium, calcium oxide, calcium hydroxide
- (B) calcium hydroxide, calcium oxide, calcium
- (C) calcium hydroxide, calcium, calcium oxide
- (D) calcium, calcium hydroxide, calcium oxide

33. Consider the following statements about graphite and diamond :

1. Physical properties of graphite and diamond are different.
2. Graphite is smooth and slippery.
3. Graphite is a good conductor of electricity.
4. Diamond is a good conductor of heat.
5. In diamond each carbon atom is bonded to three other carbon atoms whereas in graphite each carbon atom is bonded to four other carbon atoms.

The **correct** statements are

- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 1, 2 and 5
- (D) 1, 2, 3 and 5

34. The soap molecule has

- (A) hydrophilic head and hydrophilic tail
- (B) hydrophilic head and hydrophobic tail
- (C) hydrophobic head and hydrophobic tail
- (D) hydrophobic head and hydrophilic tail

35. Arrange the following elements in the order of their increasing non-metallic character :

Be, C, F, O, Li

- (A) $\text{Li} < \text{O} < \text{Be} < \text{C} < \text{F}$
- (B) $\text{Li} < \text{Be} < \text{C} < \text{O} < \text{F}$
- (C) $\text{Li} < \text{Be} < \text{O} < \text{C} < \text{F}$
- (D) $\text{Li} < \text{C} < \text{Be} < \text{O} < \text{F}$

36. Within the periods from left to right, increasing atomic numbers (Z) are commonly accompanied by

- (A) decreasing atomic radii and increasing electronegativities of atoms
- (B) increasing atomic radii and decreasing electronegativities of atoms
- (C) decreasing atomic radii and decreasing electronegativities of atoms
- (D) increasing atomic radii and increasing electronegativities of atoms

37. Consider the following statements :

- 1. Cytoplasm is also called protoplasm.
- 2. Golgi apparatus is involved with the formation of lysosomes.
- 3. Mitochondria is said to be the powerhouse of cells as ATP is generated in them.
- 4. Nucleus, mitochondria and plastids have DNA, hence they can make their own structural proteins.

The **correct** statements are

- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 3, 4 and 1
- (D) 3 and 4 only

38. The cell organelle which helps in the process of membrane biogenesis is

- (A) rough endoplasmic reticulum
- (B) smooth endoplasmic reticulum
- (C) plastid
- (D) Golgi apparatus

39. Consider the following statements about plant tissues :

1. Parenchymatous tissues have intercellular spaces.
2. Collenchymatous tissues are irregularly thickened at the corners.
3. Apical and intercalary meristems are permanent tissues.
4. Apical meristem is present at the growing tips of stems and roots.

The **correct** statements are :

- (A) 1, 2 and 3
- (B) 2, 3 and 4
- (C) 1, 2 and 4
- (D) 1, 3 and 4

40. Bone matrix is rich in

- (A) calcium and phosphorous
- (B) calcium and potassium
- (C) calcium and iodide
- (D) phosphorous and potassium

41. A student finds a herbaceous flowering plant in his school garden. This plant has leaves with parallel venation. Which of the following additional features would be observed in the given plant?

1. Its embryo has two cotyledons.
2. Its flowers possess three sepals.
3. It possesses tap roots.
4. It has no secondary vascular tissue.

- (A) 1 and 3 only
- (B) 2 and 4 only
- (C) 2, 3 and 4
- (D) 1, 2 and 3

42. Coral reefs are formed from exoskeletons of

- (A) coelenterates
- (B) echinoderms
- (C) molluscs
- (D) fishes

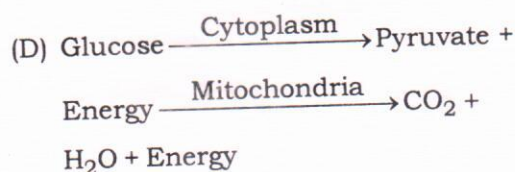
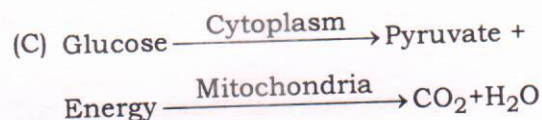
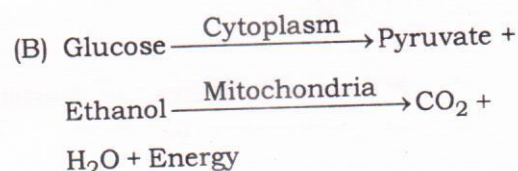
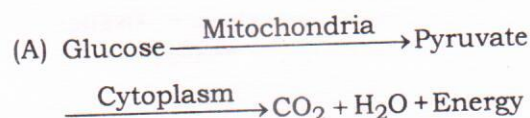
43. Water is necessary for the growth of plants. In daily life we find that most of the terrestrial plants do not grow well in soil flooded with water. The reason for this is that

- (A) the roots swell due to absorption of water
- (B) the roots do not get sufficient amount of nutrients
- (C) the roots absorb high amount of salts which are harmful to plants
- (D) the roots do not get proper amount of oxygen from the soil

44. In green plants, the time when the rate of photosynthesis is equal to the rate of respiration is usually

- (A) dawn and dusk
- (B) 11 A.M.
- (C) 3 P.M.
- (D) 9 P.M.

45. Which of the following is **most appropriate** for aerobic respiration?



46. In plants, control and coordination of different responses to environment is done by

- (A) enzymes
- (B) vitamins
- (C) hormones
- (D) receptors

47. Which of the following statements about transmission of nerve impulse is **incorrect**?

- (A) Nerve impulse travels from dendritic end towards axonal end.
- (B) At the dendritic end, electrical impulses bring about the release of some chemicals which generate an electrical impulse at the axonal end of another neuron.
- (C) The chemicals released from the axonal end of one neuron cross the synapse and generate a similar electrical impulse in a dendrite of another neuron.
- (D) A neuron transmits electrical impulses not only to another neuron but also to muscle and gland cells.

48. Which one of the following modes of reproduction allows greater variations amongst its offsprings?

- (A) Binary fission
- (B) Vegetative propagation
- (C) Seed formation
- (D) Spore formation

49. Parts of an embryo enclosed in a seed of an angiosperm are

- (A) seed coat, cotyledons, plumule
- (B) endosperm, radicle, plumule
- (C) endosperm, cotyledons, radicle
- (D) cotyledons, plumule, radicle

50. Colour blind vision trait is present on 'X' chromosome of human beings but it is not present on 'Y' chromosome. Dominant trait 'X' leads to normal vision. Recessive trait 'x' is expressed as colour blindness in absence of dominant trait. If a colour blind woman marries a normal visioned man, then the offsprings will be

- (A) normal-visioned sons
- (B) colour-blind sons
- (C) colour-blind daughters
- (D) colour-blind sons and daughters both

51. Some dinosaurs had feathers but they could not fly whereas birds have feathers that help them to fly. In the context of evolution this means that

- (A) reptiles have evolved from birds
- (B) birds have evolved from reptiles
- (C) there is no evolutionary relation between dinosaurs and birds
- (D) feathers are homologous structures in both the organisms

52. A particle moves along the X -axis from x_i to x_f . Which one of the following values of the initial and final coordinates represents the largest displacement of the object?

(A) $x_i = -4 \text{ m}; x_f = -8 \text{ m}$

(B) $x_i = -4 \text{ m}; x_f = 4 \text{ m}$

(C) $x_i = -4 \text{ m}; x_f = 2 \text{ m}$

(D) $x_i = 4 \text{ m}; x_f = -2 \text{ m}$

53. A person travelling along a straight line, covers first half of his journey with a velocity v_1 and next half with a velocity v_2 . The average velocity of the entire journey is

(A) $\frac{v_1 + v_2}{2}$

(B) $\frac{2v_1v_2}{v_1 + v_2}$

(C) $\sqrt{v_1v_2}$

(D) $\sqrt{\frac{v_1}{v_2}}$

54. A bullet of mass m moving with velocity v hits a wooden block of mass M at rest lying on a smooth horizontal surface, the bullet get embedded in the block, the velocity of the combination will be

(A) $\frac{m}{m + M}$

(B) $\frac{mv}{m + M}$

(C) $\frac{mv}{m - M}$

(D) $\frac{(m + M)}{m}v$

55. An object is thrown vertically upwards and rises to a height of 80 m. The time taken by the object to reach the highest point is ($g = 10 \text{ ms}^{-2}$)

(A) 8 s

(B) 6 s

(C) 4 s

(D) 2 s

56. Two identical spheres of mass 100 kg and radius 0.1 m are placed 2.0 m apart on a horizontal table. The total force experienced by a sphere of mass 1 kg kept at the midpoint of the line joining the two masses, in terms of universal gravitational constant (G), is

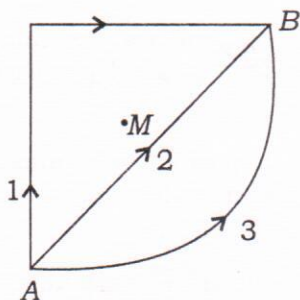
(A) $200G$

(B) $400G$

(C) $800G$

(D) zero

57. If w_1 , w_2 and w_3 represent the work done in moving a body of mass m from point A to point B along three different paths 1, 2 and 3 respectively in the gravitational field of body of mass M as shown. Which one of the following is **correct**?



- (A) $w_1 > w_3 > w_2$
- (B) $w_3 > w_1 > w_2$
- (C) $w_2 > w_3 > w_1$
- (D) $w_1 = w_2 = w_3$
58. If the kinetic energy of a body is increased by 300%, then the percentage increase in the linear momentum of the body will be

- (A) 200%
- (B) 100%
- (C) 300%
- (D) 50%

59. Sound waves are travelling from water to air. Which one of the following statements is **correct** about the frequency (ν) and wavelength (λ) as sound wave passes from water to air?

- (A) ν remains unchanged but λ decreases
- (B) ν remains unchanged but λ increases
- (C) λ remains unchanged but ν decreases
- (D) ν and λ both remain unchanged

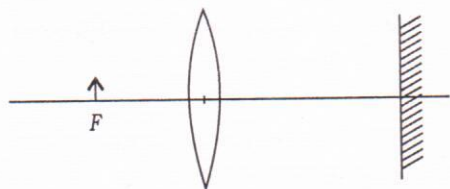
60. Which one of the following disease causing organisms live inside the host cells?

- (A) Worms
- (B) Bacteria
- (C) Fungi
- (D) Virus

61. An object is placed at a distance of 10 cm in front of a spherical mirror of radius of curvature -40 cm. The image distance and the magnification of the image produced by the mirror respectively would be

- (A) $+20$ cm and -2.0
- (B) $+20$ cm and $+2.0$
- (C) -20 cm and $+2.0$
- (D) -20 cm and -2.0

62. An object is placed at the focus F of a convex lens. A plane mirror is held perpendicular to the principal axis of the lens as shown below :



Select the **correct** statement from the following :

- (A) A virtual and erect image of the object will be formed in the mirror.
 - (B) A virtual and inverted image of the object will be formed at F .
 - (C) A real and erect image of the object will be formed in the mirror.
 - (D) A real and inverted image of the object will be formed at F .
63. A doctor has prescribed a corrective lens of power -2.5 D to a patient suffering from defect of vision. The focal length and the type of lens prescribed is
- (A) diverging lens with a focal length of -0.40 m
 - (B) diverging lens with a focal length of $+0.40$ m
 - (C) converging lens with a focal length of -0.40 m
 - (D) converging lens with a focal length of $+0.40$ m

64. A person is suffering from a defect of vision. The optician prescribed him to wear lenses of power $+4$ D. This means that the person is suffering from

- (A) myopia and he must use concave lens of focal length 0.25 m
- (B) myopia and he must use convex lens of focal length 0.25 m
- (C) hypermetropia and he must use convex lens of focal length 0.25 m
- (D) hypermetropia and he must use concave lens of focal length 0.25 m

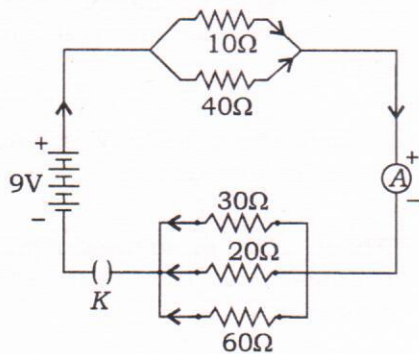
65. Consider the following phenomena of light occurring in nature :

1. Reddish appearance of the sun at sunset
2. Advance sunrise and delayed sunset
3. Blue colour of water in deep lakes
4. Twinkling of stars in the sky

Which of these phenomena occur due to scattering of light?

- (A) 1 and 2 only
- (B) 3 and 4 only
- (C) 1 and 3 only
- (D) 1, 2 and 3 only

66. Consider the following circuit :



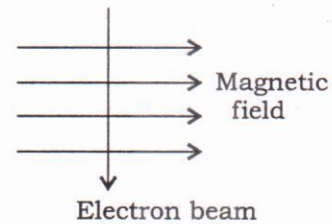
If key is plugged in for one minute in this circuit, the charge that will flow in the circuit would be

- (A) 15 C
- (B) 30 C
- (C) 60 C
- (D) 90 C

67. The potential difference between the two terminals of an electric heater is 60 V when it draws a current of 4 A from the source. What current will the heater draw if the potential difference is increased to 120 V?

- (A) 2 A
- (B) $\frac{1}{4}$ A
- (C) 8 A
- (D) $\frac{1}{2}$ A

68. An electron beam enters a magnetic field at right angle to it as shown below :



The direction of force acting on the electron beam will be

- (A) to the right
- (B) to the left
- (C) out of the page
- (D) into the page

69. Which one of the following groups of diseases can be prevented by public hygiene measures?

- (A) Polio, Malaria, TB
- (B) Rabies, Dengue, HIV
- (C) Rabies, Cancer, Polio
- (D) Malaria, HIV, TB

70. Depletion of ozone layer is caused by

- (A) methane
- (B) carbon monoxide
- (C) CFCs
- (D) nitrogen dioxide

71. The **correct** statements about manure are

1. Manure contains large quantities of organic matter and small quantities of nutrients.
2. It increases the water holding capacity of sandy soil.
3. It helps in draining out of excess of water from clayey soil.
4. Its excessive use pollutes environment because it is made up of animal excretory waste.

- (A) 1 and 3 only
(B) 1 and 2 only
(C) 2 and 3 only
(D) 3 and 4 only

72. Growing leguminous crops alternately with wheat and paddy crops is an example of

- (A) crop rotation
(B) mixed cropping
(C) crop protection
(D) intercropping

73. The power generated in a windmill

- (A) is more in rainy season since damp air would mean more mass hitting the blades
(B) depends on the height of the tower
(C) depends on wind velocity
(D) can be increased by planting tall trees close to the tower

74. Consider the following statements :

1. Green plants capture about 10% of the energy of sunlight that falls on their leaves and convert it into food energy.
2. A food chain usually consists of three or four trophic levels.
3. About 10% of organic matter is available to the next level of consumers.
4. Energy flow is unidirectional in nature.

Which of the above statements are **true** for food chains?

- (A) 1 and 2 only
(B) 1, 2 and 3
(C) 2, 3 and 4
(D) 1 and 4 only

75. Which of the following statements is **not** correct?

- (A) Economic development is linked to environmental conservation.
(B) Sustainable development is long planned and persistent development.
(C) Sustainable development does not consider the viewpoints of stakeholders.
(D) Sustainable development encourages development for current generation and conservation of resources for future generations.

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