SEAL

Test Booklet Number	Subject Code : 1701	Roll Number
00118	**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 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.

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MATHEMATICS

1. To rationalize the denominator of

$$\frac{1}{a+b\sqrt{x}}$$

we multiply it by

(A) $a+b\sqrt{x}$ (B) $a-b\sqrt{x}$

(C) $\frac{a-b\sqrt{x}}{a-b\sqrt{x}}$ (D) $\frac{a+b\sqrt{x}}{a+b\sqrt{x}}$

2. The value of

$$\frac{1}{1+\sqrt{2}}+\frac{1}{\sqrt{2}+\sqrt{3}}+\frac{1}{\sqrt{3}+\sqrt{4}}+\frac{1}{\sqrt{4}+\sqrt{5}}$$
$$+\frac{1}{\sqrt{5}+\sqrt{6}}+\frac{1}{\sqrt{6}+\sqrt{7}}+\frac{1}{\sqrt{7}+\sqrt{8}}+\frac{1}{\sqrt{8}+\sqrt{9}}$$

is

(A) 4 (B) 1

(C) 2 (D) 0

3. If $2y^3+my^2+11y+m+3$ is exactly divisible by $2y-1$, then the value of m is

(A) 7 (B) –7

(C) 6 (D) –6

4. If $x=2+\sqrt{3}$, then the value of

$$x^2+\frac{1}{x^2}$$

is

(A) 4 (B) 16

(C) 14 (D) 18

5. $(x+1)$ is a factor of x^n+1 only if n is

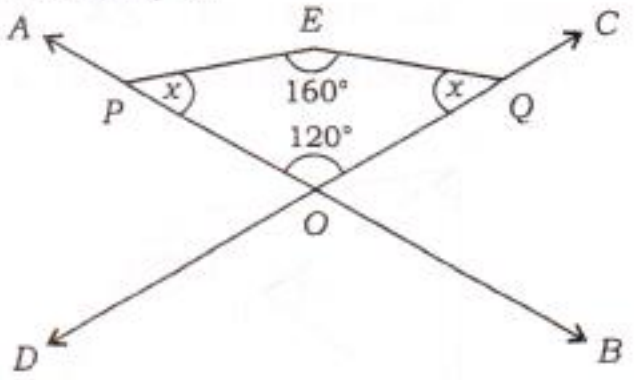
(A) an even number

(B) an odd number

(C) any natural number

(D) a prime number

6. In the given figure, the value of $(x+\angle AOD)$ is



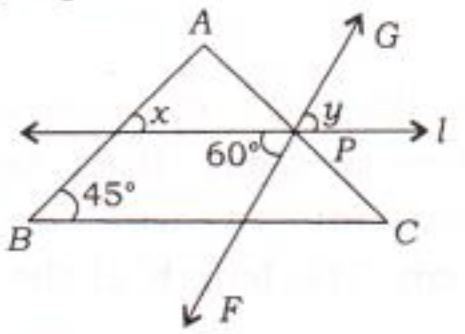
(A) 60°

(B) 75°

(C) 100°

(D) 120°

7. In the given figure, if $l \parallel BC$, then $x+y$ equals



(A) 50°

(B) 60°

(C) 80°

(D) 105°

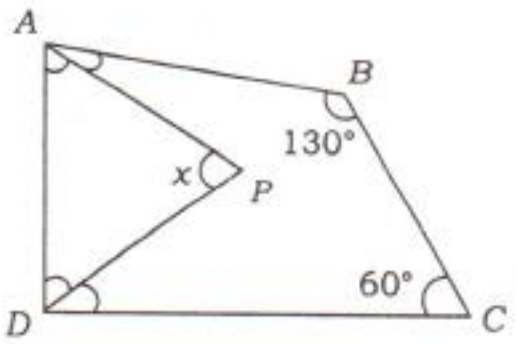
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8. $ABCD$ is a parallelogram and O is the point of intersection of its diagonals AC and BD. If the area of $\Delta AOD = 8\ cm^2$, the area of the parallelogram is

(A) $48\ cm^2$ (B) $24\ cm^2$

(C) $16\ cm^2$ (D) $32\ cm^2$

9. In the given figure, $ABCD$ is a quadrilateral in which AP and DP are bisectors of $\angle A$ and $\angle D$ respectively. The value of x is



(A) 60°

(B) 85°

(C) 95°

(D) 100°

10. The diameter of a solid copper sphere is 6 cm. It is beaten and drawn into a wire of diameter 0·2 cm. The length of the wire is

(A) 36 centimeter

(B) 36 decimeter

(C) 36 meter

(D) 360 meter

11. If HCF of $(120, 75) = 125 \times 9 - 10x$, then the value of x is

(A) 50 (B) 15

(C) 111 (D) 125

12. If α, β are the zeroes of the polynomial $x^2 - k(x+1) + c$ such that $(\alpha + 1)(\beta + 1) = 0$, then c equals

(A) -1 (B) 0

(C) 1 (D) ± 1

13. The value of

$$\left(1+\frac{1}{x}\right)\left(1+\frac{1}{x+1}\right)\left(1+\frac{1}{x+2}\right)\left(1+\frac{1}{x+3}\right)$$

is

(A) $1+\frac{1}{x+1}$

(B) $\frac{1}{x+4}$

(C) $\frac{x}{x+4}$

(D) $\frac{x+4}{x}$

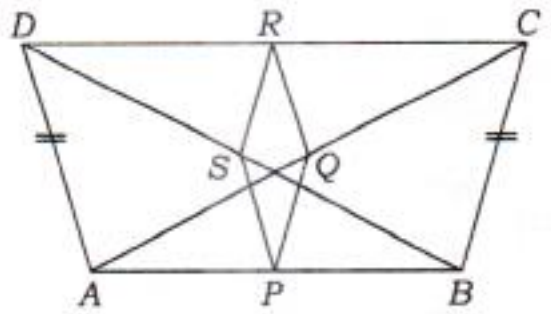
14. The first four terms of an arithmetic sequence are a, x, b and $2x$. The ratio of a to b is

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

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

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15. In the following figure, $ABCD$ is a quadrilateral with $AD = BC$. If P, Q, R and S are the midpoints of AB, AC, CD and BD respectively, then $PQRS$ is a



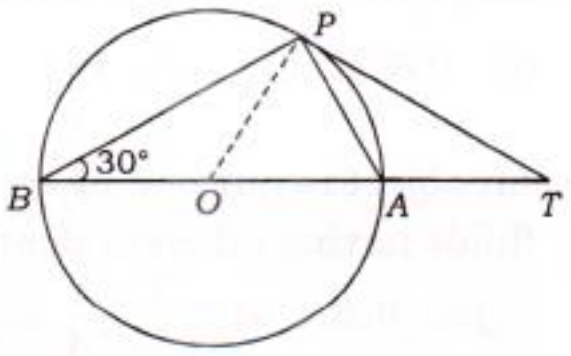
(A) rectangle

(B) rhombus

(C) square

(D) trapezium

16. In the given figure, BA is a diameter and the tangent at P meets BA produced at T. If $\angle PBA = 30°$ and $AP = AT$, then $\angle PTA$ equals



(A) 60° (B) 45°

(C) 30° (D) 25°

17. $\frac{\sin x}{1+\cos x} + \frac{\sin x}{1-\cos x}$ equals

(A) $2\sin x$ (B) $2\cos x$

(C) $2\sec x$ (D) $2\operatorname{cosec} x$

18. A person walking 20 m towards a chimney in a horizontal line through its base, observes that its angle of elevation changes from 30° to 45°. The height of the chimney is

(A) $10(\sqrt{3}+1)$

(B) $\frac{20}{\sqrt{3}+1}$

(C) $20(\sqrt{3}-1)$

(D) $20(\sqrt{3}+1)$

19. The sum of radii of two circles is 140 cm and the difference of their circumferences is 88 cm. The ratio of the diameters of two circles is

(Use $\pi = \frac{22}{7}$)

(A) 77 : 64

(B) 11 : 9

(C) 9 : 17

(D) 12 : 11

20. The king, queen and jack of diamond are removed from pack of 52 cards and then the pack is well shuffled. A card is drawn from the remaining cards. The probability of getting a card of diamond is

(A) $\frac{1}{4}$

(B) $\frac{13}{49}$

(C) $\frac{3}{49}$

(D) $\frac{10}{49}$

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21. A car runs at a uniform rate on a circular track of radius 100 m taking 62·8 s on each lap. The average velocity and average speed of the car for one complete lap are respectively

(A) $10\ ms^{-1}$ and $10\ ms^{-1}$

(B) 0 and 0

(C) 0 and $10\ ms^{-1}$

(D) $10\ ms^{-1}$ and 0

22. An object of mass 5 kg is sliding with a constant velocity of $6\ ms^{-1}$ on a frictionless horizontal surface. The force required to keep the object moving with the same velocity is

(A) 180 N (B) 90 N

(C) 30 N (D) zero

23. A child in a moving train tosses a coin vertically upwards. The coin falls behind him after some time. From this event it may be inferred that the motion of the train is

(A) uniform

(B) along a circular track

(C) accelerated

(D) retarded

24. If the linear momentum of a body of mass m is p, then its kinetic energy at that instant will be

(A) $\frac{p^2}{2m}$

(B) $\frac{p^2}{m}$

(C) p^2m^2

(D) $\frac{p^2}{m^2}$

25. Two bodies, one held 1 m vertically above the other, are released simultaneously and fall freely under gravity. If the value of g is $9{\cdot}8\ ms^{-2}$, the relative separation between the two bodies after 2 seconds will be

(A) 1 m (B) 4·9 m

(C) 9·8 m (D) 19·6 m

26. An object is put one by one in three fluids having different densities. The object floats with $\frac{1}{8}$, $\frac{2}{13}$ and $\frac{3}{17}$ part of its volume outside the fluids' surfaces in the fluids of densities d_1, d_2 and d_3 respectively. On the basis of this information, the correct option is

(A) $d_1 < d_2 < d_3$

(B) $d_1 > d_2 > d_3$

(C) $d_1 > d_2 < d_3$

(D) $d_1 < d_2 > d_3$

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27. Consider the following situations :

1. Seema skating on the road.
2. Porter carrying the load on his head.
3. Arun displacing a chair from drawing room to the kitchen.
4. Maya lifting a bag from ground and keeping on her head.

In which of the above situations the work is said to be done as per definition of work?

(A) 1 and 3 only

(B) 1 and 4 only

(C) 1, 2 and 3

(D) 1, 3 and 4

28. Consider the following units of physical quantities :

1. kilowatt-hour
2. kilowatt
3. joule
4. newton metre
5. kilogram metre sec^{-2}

The units of energy are

(A) 1, 2 and 3

(B) 1, 3 and 4

(C) 1, 3 and 5

(D) 2, 3 and 4

29. A key of a mechanical piano struck gently and then struck again but much harder this time. In the second case the sound produced by the piano will be

(A) louder but pitch will not be different

(B) louder and pitch will also be higher

(C) louder but pitch will be lower

(D) of same pitch and loudness as in the first case

30. Which of the following parts of human ear converts the vibrations into electrical signal?

(A) Anvil

(B) Eustachian tube

(C) Cochlea

(D) Auditory nerve

31. A ray of light passes from glass to water and bends away from the normal in the latter medium. Which of the following is correct?

(A) Ratio of refractive index of water to that of glass is 0

(B) Ratio of refractive index of water to that of glass is 1

(C) Ratio of refractive index of water to that of glass is less than 1

(D) Ratio of refractive index of water to that of glass is more than 1

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32. A student, while observing the diagram showing the path of a ray of light passing through a glass prism, found that for all angles of incidence the ray of light bends

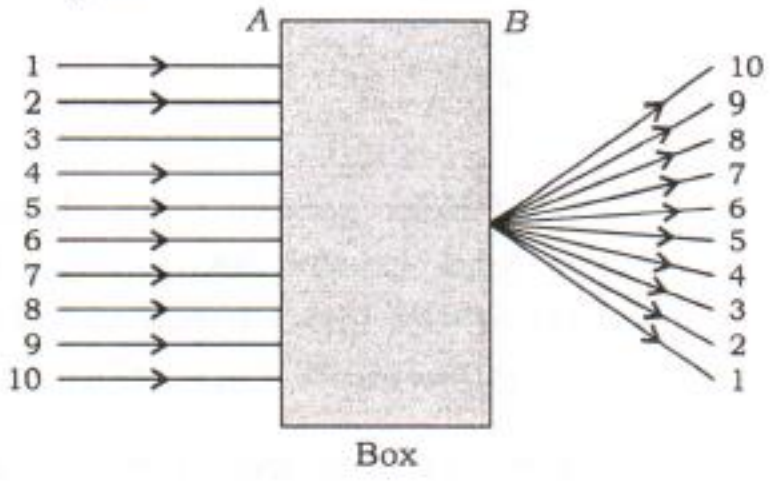
(A) away from the normal while entering into the prism and towards the normal while emerging out of the prism

(B) away from the normal while entering as well as while emerging out of the prism

(C) towards the normal while entering into the prism and away from the normal while emerging out of the prism

(D) towards the normal while entering as well as while emerging out of the prism

33. A beam of light falls on side *A* of a box having holes as shown in the figure :



The beam of light emerges out of the hole from the side *B* of the box. Which of the following could be there inside the box?

(A) Convex lens

(B) Concave lens

(C) Rectangular glass slab

(D) Prism

34. If a diverging lens of focal length f is to be used to form an image which is one-third of the size of the object, where must the object be placed at?

(A) $+2f$

(B) $-2f$

(C) $-3f$

(D) $+3f$

35. The image of an object placed in front of a convex lens is magnified and inverted. If the lens is replaced by a concave lens of the same focal length, the image obtained will be

(A) magnified and erect

(B) magnified and inverted

(C) diminished and erect

(D) diminished and inverted

36. Select the correct arrangement on the basis of conductivity of materials.

(A) Silver > Copper > Aluminium > Tungsten > Water

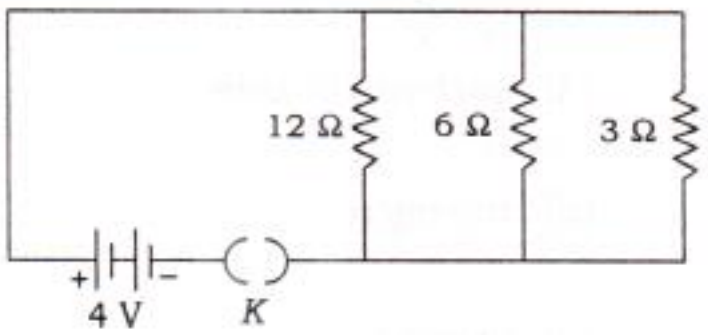
(B) Silver > Aluminium > Copper > Constantan > Water

(C) Copper > Silver > Aluminium > Tungsten > Water

(D) Water > Tungsten > Aluminium > Copper > Silver

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37. Consider the following circuit :



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

(A) 84 C

(B) 140 C

(C) 168 C

(D) 336 C

38. Four identical resistors connected in series with an electric source consumes 44 W power. If these resistors are connected in parallel to the same source, the power consumed by them would be

(A) 11 W

(B) 176 W

(C) 352 W

(D) 704 W

39. The strength of magnetic field inside a long current carrying straight solenoid is

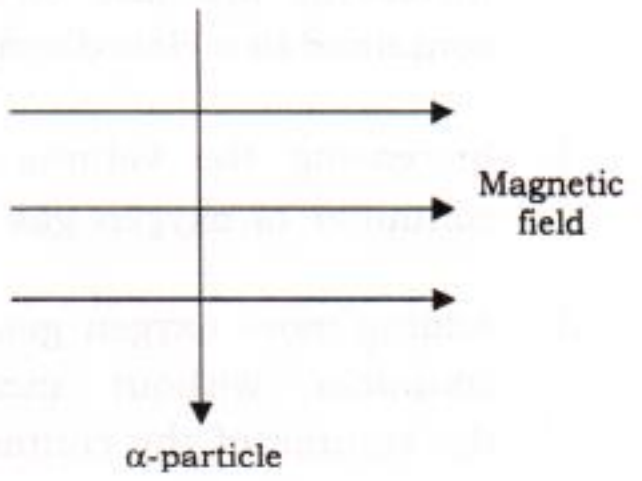
(A) same at all points

(B) minimum in the middle

(C) more at the ends than at the centre

(D) found to increase from one end to the other

40. An α-particle enters a magnetic field at right angles to it as shown in the figure :



The direction of force acting on the α-particle will be

(A) to the right

(B) to the left

(C) out of the page

(D) into the page

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41. The melting points of four solids *A*, *B*, *C* and *D* are 78 °C, 260 °C, 100 °C and 180 °C respectively. The interparticle forces of attraction would be in the order

(A) $A > C > D > B$

(B) $B > C > D > A$

(C) $B > D > C > A$

(D) $A > D > C > B$

42. Under which of the following conditions, the distance between the molecules of oxygen gas would increase?

1. Increasing pressure on oxygen contained in a closed container.

2. Increasing the volume of the container of oxygen gas.

3. Adding more oxygen gas to the container without increasing the volume of the container.

4. Some oxygen gas leaking out of the container.

The correct conditions are

(A) 1 and 2

(B) 1 and 4

(C) 2 and 3

(D) 2 and 4

43. The most volatile fraction of air is

(A) carbon dioxide

(B) nitrogen

(C) oxygen

(D) argon

44. Which of the following is a colloidal solution?

(A) Sugar solution

(B) Tincture iodine

(C) Milk

(D) Soda water

45. The atomic mass of calcium is 40·0 u. The number of calcium atoms in 0·4 g of calcium is

(A) $6{\cdot}022 \times 10^{20}$

(B) $6{\cdot}022 \times 10^{21}$

(C) $6{\cdot}022 \times 10^{22}$

(D) $6{\cdot}022 \times 10^{23}$

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46. Magnesium and oxygen react according to the following reaction :

$$2\ Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

0·5 mol of magnesium oxide will be formed if

(A) 0·5 mol of magnesium reacts with 0·25 mol of oxygen

(B) 0·5 mol of magnesium reacts with 0·5 mol of oxygen

(C) 0·5 mol of magnesium reacts with 1·0 mol of oxygen

(D) 1·0 mol of magnesium reacts with 0·25 mol of oxygen

47. Which of the following contains maximum number of molecules?

(A) 1 g of CO_2

(B) 1 g of N_2

(C) 1 g of H_2

(D) 1 g of CH_4

48. Which of the following represent 180 g of water?

(A) 2 moles of H_2O

(B) 20 moles of H_2O

(C) $6{\cdot}022 \times 10^{24}$ molecules of water

(D) $1{\cdot}2044 \times 10^{25}$ molecules of water

49. In Rutherford's experiment on scattering of α-particles, most of the α-particles go straight through the gold foil because

(A) α-particles are much smaller than electrons

(B) most of the space inside atom is empty

(C) α-particles move with low velocity

(D) α-particles are positively charged

50. The species represented by $^{35}_{17}Cl^-$ contains

(A) 17 protons, 18 neutrons and 18 electrons

(B) 17 protons, 18 neutrons and 17 electrons

(C) 17 neutrons, 18 protons and 18 electrons

(D) 18 protons, 17 neutrons and 18 electrons

51. Which of the following compounds will release two gases on heating?

(A) Na_2SO_4

(B) $Al_2O_3 \cdot 2H_2O$

(C) NH_4NO_3

(D) $CaCO_3$

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52. The chemical equation

$Mg(s) + CuO(s) \rightarrow MgO(s) + Cu(s)$

is an example of

(A) a combination reaction as well as a displacement reaction

(B) a combination reaction as well as a double displacement reaction

(C) a redox reaction as well as a displacement reaction

(D) a double displacement reaction as well as a redox reaction

53. A few drops of phenolphthalein indicator are added to an unknown solution *A*. It acquires pink colour. Now, another unknown solution *B* is added to it drop-by-drop, the solution ultimately becomes colourless. The nature of solution *B* is

(A) acid (B) base

(C) water (D) salt

54. Generally metals react with moderately dilute acids to give salt and hydrogen gas. Which of the following acids ***does not*** evolve hydrogen gas on reacting with metals?

(A) HNO_3 (B) HCl

(C) H_2SO_4 (D) CH_3COOH

55. Which salt among the following ***does not*** contain any water of crystallization?

(A) Gypsum

(B) Washing soda

(C) Baking soda

(D) Blue vitriol

56. Which of the following will form acidic oxide?

(A) An element with atomic number 16

(B) An element with atomic number 11

(C) An element with atomic number 18

(D) An element with atomic number 4

57. Elements *X* and *Y* react to form a compound *Z*. During the reaction, *X* loses electron and *Y* gains electron. Consider the following properties :

1. Has high melting point
2. Soluble in organic solvents like petrol, benzene, etc.
3. Conducts electricity in molten state
4. Occurs as solid

The properties shown by *Z* are

(A) 1 and 2 only

(B) 3 and 4 only

(C) 1, 3 and 4

(D) 1, 2 and 3

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58. Which of the following elements would lose an electron most easily?

(A) Ca

(B) K

(C) Na

(D) Mg

59. Which one of the following compounds possesses ketone group?

(A) CH_3CHO

(B) CH_3COCH_3

(C) CH_3COOCH_3

(D) $CH_3CH(OH)CH_3$

60. Which of the following pairs of reactants on reacting with each other will form an ester?

(A) CH_3COOH and C_2H_5OH

(B) CH_3COONa and NaOH

(C) $CH_3COOC_2H_5$ and NaOH

(D) CH_3CH_2OH and Na

61. Which one of the following types of tissue is ***not*** found in animals?

(A) Meristematic tissue

(B) Muscular tissue

(C) Nervous tissue

(D) Epithelial tissue

62. The cell organelle which plays a crucial role in detoxifying many poisons and drugs in a cell is

(A) Golgi apparatus

(B) lysosomes

(C) rough endoplasmic reticulum

(D) smooth endoplasmic reticulum

63. The husk of a coconut is made of

(A) aerenchymatous tissue

(B) sclerenchymatous tissue

(C) parenchymatous tissue

(D) collenchymatous tissues

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64. The non-motile animals having holes all over the body leading to a canal system that helps in circulating water throughout the body to bring in food and oxygen belong to

(A) Platyhelminthes

(B) Porifera

(C) Coelenterata

(D) Nematoda

65. The example of the organism that breaks down the food material outside the body and then absorbs it, is

(A) *Cuscuta*

(B) mushroom

(C) tapeworm

(D) amoeba

66. In case of unicellular organisms, cell division or fission leads to creation of new individuals. Identify the organism which reproduces through binary fission.

(A) *Plasmodium*

(B) Yeast

(C) *Leishmania*

(D) *Chlamydomonas*

67. Which of the following are produced during the breakdown of glucose when there is lack of oxygen in our muscles?

(A) Lactic acid and energy

(B) Pyruvate and energy

(C) Ethanol, carbon dioxide and energy

(D) Carbon dioxide, water and energy

68. Which of the following is a reproductive part of flowers as well as of humans?

(A) Vas deferens

(B) Anther

(C) Ovary

(D) Style

69. The correct sequence of the components of a reflex arc is

(A) receptors → sensory neuron → spinal cord → motor neuron → effector

(B) receptors → spinal cord → effector → motor neuron → sensory neuron

(C) receptors → sensory neuron → spinal cord → effector → motor neuron

(D) receptors → motor neuron → spinal cord → sensory neuron → effector

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70. Consider the following gases :

1. Carbon monoxide
2. Carbon dioxide
3. Ammonia
4. Methane

Out of these, the greenhouse gases are

(A) 1 and 3 only

(B) 2 and 4 only

(C) 2, 3 and 4

(D) 1, 2 and 4

71. Growing of few rows of soya bean crop alternate with a few rows of maize crop is an example of

(A) crop rotation

(B) inter-cropping

(C) mixed cropping

(D) crop protection

72. Consider the following gases :

1. Carbon monoxide
2. Carbon dioxide
3. Natural gas
4. Nitrogen dioxide

The gases which contribute towards acid rain formation are

(A) 1 and 2

(B) 2 and 3

(C) 3 and 4

(D) 2 and 4

73. Consider the following statements :

1. 10% of organic matter is available to the next level of consumer.
2. Energy flow is cyclic in nature.
3. Very little energy is available for the next level of consumer.
4. A food chain generally consists of only three or four trophic levels.

Which of the above statements are true for food chains?

(A) 1 and 2 only

(B) 3 and 4 only

(C) 1, 2 and 3

(D) 1, 3 and 4

74. The formation of ozone hole in the higher level of atmosphere is due to

(A) greenhouse gases

(B) ultraviolet rays

(C) chlorofluorocarbons

(D) carbon monoxide

75. The major problem in harnessing the nuclear energy is to

(A) dispose off the nuclear waste of the reactors

(B) split heavy nucleus

(C) sustain nuclear reactions

(D) convert nuclear energy into other useful forms of energy

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