SEAL

Test Booklet Number	Subject Code : 1801	Roll Number
00325	**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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SPACE FOR ROUGH WORK

MATHEMATICS

1. The largest positive integer that will divide 398, 436 and 542 leaving remainders 7, 11 and 15 respectively is

(A) 13 (B) 15

(C) 17 (D) 19

2. If

$$25x^2 - y = \left(5x + \frac{1}{3}\right)\left(5x - \frac{1}{3}\right)$$

then the value of y is

(A) 0 (B) $\frac{1}{\sqrt{3}}$

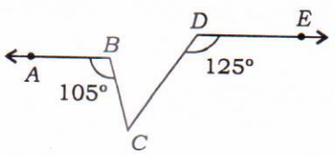
(C) $\frac{1}{9}$ (D) $\frac{1}{3}$

3. If 2 is a zero of both the polynomials $2x^2 + ax - 12$ and $2x + b$, then the value of $2a + b$ is

(A) 0 (B) 2

(C) -4 (D) 4

4. In the given figure, $AB \| DE$, $\angle ABC = 105°$ and $\angle CDE = 125°$, then $\angle BCD$ is equal to



(A) 50°

(B) 60°

(C) 45°

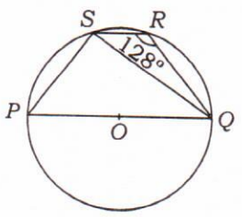
(D) None of the above

5. From a point in the interior of an equilateral triangle, perpendiculars are drawn on the three sides. If the lengths of these perpendiculars are 10 cm, 12 cm and 18 cm, then the side of the triangle (in cm) is

(A) $80\sqrt{3}$ (B) $40\sqrt{3}$

(C) $\frac{40}{\sqrt{3}}$ (D) $\frac{80}{\sqrt{3}}$

6. In the given figure, O is the centre of the circle and $\angle QRS = 128°$, then $\angle PQS$ is



(A) 90° (B) 52°

(C) 48° (D) 38°

7. If each side of a triangle is doubled, then the ratio of area of the new triangle thus formed and the given triangle is

(A) 2 : 1 (B) 6 : 1

(C) 4 : 1 (D) 8 : 1

8. If the areas of three adjacent faces of a cuboid are x, y and z, then the volume of the cuboid is

(A) $x^2y^2z^2$ (B) xyz

(C) $\sqrt{xyz}$ (D) $\sqrt[3]{xyz}$

9. The mean of 20 observations is 12·5. By error, one observation was noted as –15 instead of 15. The correct mean is

(A) 11·75 (B) 11

(C) 14 (D) 13·25

10. If the angles $\angle A$, $\angle B$, $\angle C$ and $\angle D$ of a quadrilateral $ABCD$, taken in order, are in the ratio of 3 : 7 : 6 : 4, then $ABCD$ is a

(A) rhombus

(B) kite

(C) trapezium

(D) parallelogram

11. If $D(3, -1)$, $E(2, 6)$ and $F(-5, 7)$ are the mid-points of the sides of ΔABC, then the area of the ΔABC is

(A) 96 sq. units

(B) 24 sq. units

(C) 48 sq. units

(D) 50 sq. units

12. ABC is a right-angled triangle, right angled at B such that $BC = 6$ cm and $AB = 8$ cm. A circle with centre O is inscribed in the ΔABC. The radius of the circle (in cm) is

(A) 1 (B) 2

(C) 3 (D) 4

13. A man can row at the speed of 6 km/h in still water. If the speed of the current is 2 km/h, it takes him 3 hours more in going upstream than coming downstream for the same distance. The distance (in km) is

(A) 24 (B) 20

(C) 32 (D) 30

14. If ΔABC is similar to ΔEDF and ΔABC is not similar to ΔDEF, then which of the following is not true?

(A) $BC \cdot EF = AC \cdot FD$

(B) $AB \cdot EF = AC \cdot DE$

(C) $BC \cdot DE = AB \cdot EF$

(D) $BC \cdot DE = AB \cdot FD$

15. When the angle of elevation of the sun changes from 30° to 45°, the shadow of a 100 m tower decreases by

(A) $\frac{100}{\sqrt{3}}$ m

(B) $100(\sqrt{3}-1)$ m

(C) $100\sqrt{3}$ m

(D) $50\sqrt{3}$ m

16. The length of a rectangular field exceeds its breadth by 8 m and the area of the field is 240 m^2. The breadth of the field is

(A) 20 m (B) 30 m

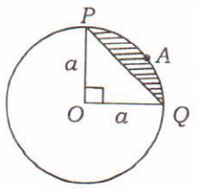
(C) 12 m (D) 16 m

17. Which term of the AP 20, $19\frac{1}{4}$, $18\frac{1}{2}$, ... is the first negative term?

(A) 18th (B) 15th

(C) 28th (D) 27th

18. In the given figure, area of the shaded region is



(A) $\frac{a^2}{4}(\pi+2)$ (B) $\frac{a^2}{4}(\pi-2)$

(C) $\frac{a^2}{4}(\pi-1)$ (D) $\frac{a^2}{2}(\pi-2)$

19. The volume of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 2 cm and height 5 cm is

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

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

(C) $\frac{32\pi}{3}$ cm^3

(D) $\frac{256\pi}{3}$ cm^3

20. A box contains cards numbered 6 to 50. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square is

(A) $\frac{1}{45}$ (B) $\frac{2}{15}$

(C) $\frac{4}{45}$ (D) $\frac{1}{9}$

21. Some water was taken in a measuring cylinder and level of water on the cylinder was noted. Now 2 g of sugar was dissolved in the water and level of water was again noted at the same temperature. There was no change in the water level. Which one of the following is the conclusion drawn from this activity?

(A) Matter is continuous having empty space in it

(B) Matter is continuous without empty space in it

(C) Matter is made up of particles having empty space between the particles

(D) Matter is made up of particles which has no empty space between the particles

22. Consider the following table in which the percentage by volume and boiling points of different gases present in liquid air are given :

	Oxygen	*Argon*	*Nitrogen*
Boiling point (°C)	–183	–186	–196
% air by volume	21	1	78

If the liquid air is allowed to warm up slowly in a fractional distillation column, in which order will these gases be obtained?

(A) Argon, nitrogen, oxygen

(B) Nitrogen, argon, oxygen

(C) Oxygen, nitrogen, argon

(D) Oxygen, argon, nitrogen

23. Consider the following statements :

1. Conversion of a substance from its solid state to gaseous state without passing through the liquid state is called vaporization.

2. Conversion of a substance from its vapour state to solid state without passing through the liquid state is called deposition.

3. Conversion of a substance from its solid state to gaseous state without passing through the liquid state is called sublimation.

4. Conversion of a substance from its gaseous state to solid state without passing through its liquid state is called condensation.

The correct statement(s) is/are

(A) 2 only

(B) 3 only

(C) 1 and 2 only

(D) 2 and 3 only

24. 1·80 g of glucose ($C_6H_{12}O_6$) is dissolved in 36·0 g of water (H_2O) in a beaker. The total number of oxygen atoms in the solution is

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

(B) $12 \cdot 405 \times 10^{22}$

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

(D) $12 \cdot 405 \times 10^{23}$

25. ^{35}Cl and ^{37}Cl are the two isotopes of chlorine in the ratio 3 : 1 respectively. If somehow this isotope ratio is reversed, the average atomic mass of chlorine would be

(A) 36·0 u (B) 36·5 u

(C) 36·7 u (D) 36·8 u

26. Which one of the following elements has two electrons in its *N* shell? (Given : Atomic number of Mg = 12, Si = 14, S = 16, Ca = 20)

(A) Magnesium

(B) Silicon

(C) Sulphur

(D) Calcium

27. A clean iron nail is placed in a blue solution of copper (II) chloride. The nail is quickly covered with copper film and the solution turns greenish.

The type of chemical reaction involved in the above activity is

(A) decomposition

(B) addition

(C) displacement

(D) double displacement

28. Which of the following statements is/are *not* always true for a balanced chemical equation representing a chemical change/ reaction?

1. The total number of molecules on the left is equal to the total number of molecules on the right.
2. The total number of atoms on the left is equal to the total number of atoms on the right.
3. The total mass of reactants is equal to the total mass of the products.
4. The total number of atoms on the left is not equal to the total number of atoms on the right.

(A) Only 1 (B) Only 2

(C) 1 and 4 (D) 1, 3 and 4

29. 2 mL concentrated aqueous solution of sodium sulphate was added to 10 mL of distilled water and its pH was determined. After that 2 mL concentrated aqueous solution of sodium hydroxide was added to it and its pH was determined. In this activity

(A) pH would first decrease and then increase

(B) pH would increase in both the cases

(C) pH would not change in the first case and then would increase in the second case

(D) pH would not change in the first case but would decrease in the second case

30. If X, Y, Z respectively are tap water, aqueous solution of ammonium chloride and acetic acid, then the sequence of increasing order of their electrical conductivities is

(A) $X < Y < Z$

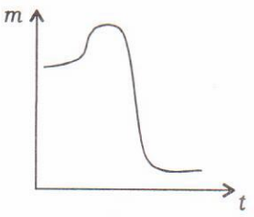
(B) $Y < X < Z$

(C) $X < Z < Y$

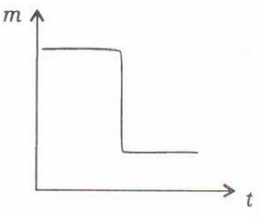
(D) $Z < X < Y$

31. A copper plate was introduced into a red-hot furnace. Which one of the following curves reflects a change in the plate mass m on oxidation to copper (II) oxide?

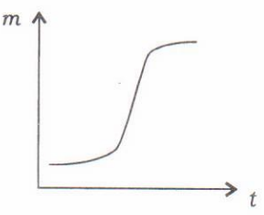
(A)



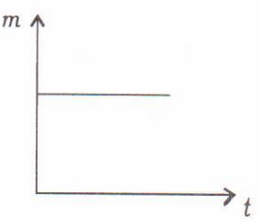
(B)



(C)



(D)



32. Consider the following statements about the reaction given below :

$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(l) + Al_2O_3(s) + heat$

1. Aluminium is more reactive than iron.
2. Aluminium is oxidized in this reaction.
3. Iron is reduced in this reaction.
4. Iron is more reactive than aluminium.

The correct statement(s) is/are

(A) 1 only

(B) 1 and 3

(C) 2, 3 and 4

(D) 1, 2 and 3

33. In the atoms of elements *X*, *Y* and *Z* the electrons present in their outermost shells are 1, 3 and 6 respectively. If the noble gas configuration is to be acquired by accepting or donating the requisite number of electrons, then the charges of the ions formed respectively will be

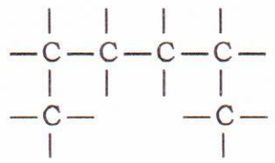
(A) +1, +3 and –2

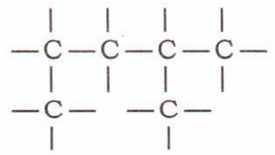
(B) –1, –5 and +2

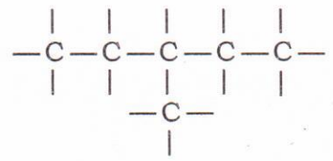
(C) +1, +5 and –2

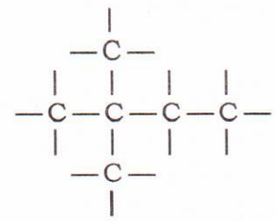
(D) +1, +3 and +2

34. Which of the following carbon skeletons corresponds to the compound whose name starts with the prefix 'iso' ?

(A)


(B)


(C)


(D)


35. Consider the following elements with their atomic numbers in parentheses :

A(3), *B*(5), *C*(7), *D*(9), *E*(11), *F*(13), *G*(15), *H*(17)

Which one of the following groups of elements is of valency 3?

(A) *A*, *B*, *C*, *D*

(B) *B*, *C*, *D*, *E*

(C) *B*, *C*, *F*, *G*

(D) *C*, *D*, *G*, *H*

36. The correct order of the elements Na, Si, P, Mg, Al as per their decreasing metallic character is

(A) P > Si > Al > Mg > Na

(B) Na > Mg > Al > Si > P

(C) Na > Al > Mg > P > Si

(D) Al > Na > Si > P > Mg

37. Which of the following are *not* the functions of ribosomes?

1. To help in manufacture of protein molecules
2. To help in manufacture of enzymes
3. To help in manufacture of lipids
4. To help in manufacture of starch molecules

(A) 1 and 2

(B) 2 and 3

(C) 3 and 4

(D) 4 and 1

38. If you puncture a ripe tomato with a needle, watery fluid oozes out. In which part of the cells this fluid is stored?

(A) Nucleus

(B) Mitochondria

(C) Nucleolus

(D) Vacuole

39. Consider the following statements :

1. The nature of matrix differs according to the function of the tissue.
2. Fats are stored below the skin and in between the internal organs.
3. Epithelial tissues have intercellular spaces between them.
4. Cells of striated muscles are multinucleate and unbranched.

The correct statement(s) is/are

(A) 1 only

(B) 1 and 2 only

(C) 2 and 3 only

(D) 1, 2 and 4

40. Which one of the following types of cells have thick and lignified cell walls?

(A) Collenchyma

(B) Sieve tube

(C) Sclerenchyma

(D) Xylem parenchyma

41. A student has observed the following features in a specimen preserved in a glass jar :

1. Jointed appendages
2. Body segmented
3. has Coelomic cavity
4. Body bilaterally symmetrical

To which one of the following phyla does the specimen belong to?

(A) Annelida

(B) Arthropoda

(C) Mollusca

(D) Nematoda

42. The body of this group of animals is flattened dorsiventrally and bilaterally symmetrical. They belong to

(A) Coelenterata

(B) Platyhelminthes

(C) Nematoda

(D) Annelida

43. The action of pepsin on protein is facilitated in

(A) any kind of medium

(B) alkaline medium

(C) neutral medium

(D) acidic medium

44. Choose the correct path of urine in our body.

(A) Kidney → ureter → urethra → urinary bladder

(B) Kidney → urinary bladder → urethra → ureter

(C) Kidney → ureter → urinary bladder → urethra

(D) Kidney → urinary bladder → ureter → urethra

45. Which of the following are produced during the breakdown of glucose when there is complete absence of oxygen in the body of the organism?

(A) Ethanol, carbon dioxide and energy

(B) Lactic acid and energy

(C) Pyruvate and energy

(D) Carbon dioxide, water and energy

46. The main function of 'thyroxin' is

(A) to regulate carbohydrate, protein and fat metabolism in the body

(B) to control sugar levels in the body

(C) to send chemical signals in the body to deal with different situations

(D) to bring sudden changes in the body at the age of puberty

47. A person has placed some small cut pieces of soft stems in growth medium with plant hormones. In which one of the following combinations of plant hormones with the cut pieces of soft stems show slowest growth?

(A) Auxin + cytokinin

(B) Auxin + gibberellin

(C) Auxin + abscisic acid

(D) Cytokinin + gibberellin

48. In a bisexual flower, the parts that produce male and female gametes (germ cells) respectively are

(A) stamens and anther

(B) anther and ovary

(C) ovary and anther

(D) stamens and stigma

49. The correct sequence of organs in human male reproductive system for transport of sperms is

(A) testis → vas deferens → ureter

(B) testis → vas deferens → urethra

(C) testis → urethra → ureter

(D) testis → ureter → urethra

50. The progeny of a cross between two tall pea plants were about 75% tall and 25% short pea plants. The genetic makeup of the two parent plants are

(A) TT and Tt

(B) Tt and Tt

(C) Tt and tt

(D) tt and tt

51. Consider the following statements :

1. Wings of birds and wings of bats are homologous organs.
2. Wings of birds and wings of insects are modified forelimbs.
3. Wings of birds and wings of insects are analogous structures.
4. Wings of birds and forelimbs of horse are homologous organs.

The correct statements are

(A) 1 and 4

(B) 2 and 3

(C) 1 and 2

(D) 3 and 4

52. A ball is dropped from a height at $t = 0$. If the ball hits the ground inelastically and rebounds with a velocity of $5\ ms^{-1}$ so as to reach the new height at $t = 1{\cdot}5$ s, the net displacement of the ball from its initial position after 1·5 s would be (taking $g = 10\ ms^{-2}$)

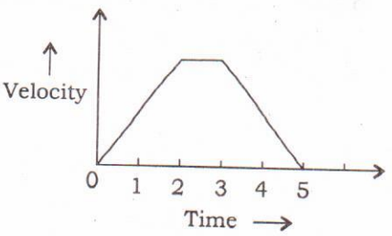
(A) 3·75 m

(B) 5·00 m

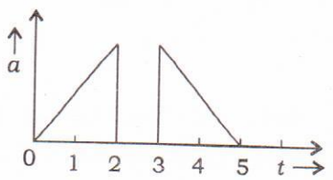
(C) 6·25 m

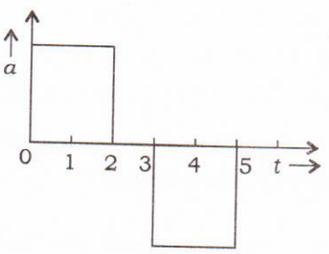
(D) 7·50 m

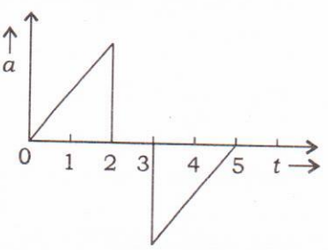
53. The velocity-time graph of rectilinear motion of an object is shown below :

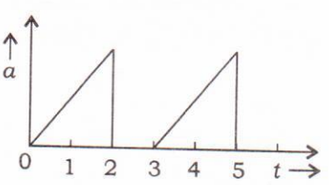


The corresponding acceleration (a) -time (t) graph for the above motion is represented by which one of the following graphs?

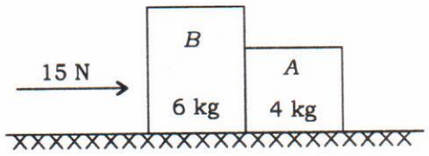
(A)


(B)


(C)


(D)


54. Two wooden blocks A and B of 4 kg and 6 kg respectively, lie on a smooth horizontal surface as shown below. If they are pushed by a horizontal force of 15 N, the force exerted by B on A would be



(A) 15 N (B) 9 N

(C) 6 N (D) 1·5 N

55. A bullet is fired in a horizontal direction from the roof of a building which is at a height of 20 m from ground. If the initial speed of the bullet is 10 m/s and acceleration due to gravity is 10 m/s^2, then which one of the following is the correct statement?

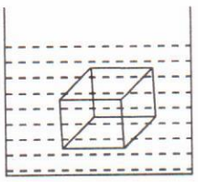
(A) After 1 second, the bullet will be at a point that is 10 m below the roof.

(B) The horizontal and vertical distances moved by the bullet will always be the same.

(C) The bullet will hit the ground at a distance of 20 m from the base of the building.

(D) The bullet will hit the ground after 2 s with a speed of 10 ms^{-1}.

56. Given figure shows a solid cube of volume V, uniform density ρ_s immersed in a liquid of density ρ_l, the apparent weight of the cube in the liquid is given as $(\rho_s - \rho_l) g V$. Then which of the following is incorrect?



(A) If $\rho_s > \rho_l$, the cube will sink.

(B) If $\rho_s = \rho_l$, the cube will float but remains wholly immersed in the liquid.

(C) If $\rho_s < \rho_l$, the cube will float but remains partially immersed in the liquid.

(D) If $\rho_s > \rho_l$, the cube will float on the liquid, no portion of it will be inside the liquid.

57. A ball of mass 200 g moving with a velocity of 10 ms^{-1} collides with a wooden block of mass 1800 g and gets embedded into it. If the compound system keeps moving in the same direction, then which one of the following statements is true about this situation?

(A) The kinetic energies before and after collision are same.

(B) The kinetic energy after collision is 9 J.

(C) There will be a loss of kinetic energy equal to 9 J.

(D) There will be a loss of kinetic energy equal to 1 J.

58. An object of mass m is moving with a velocity v. What should be the velocity of this object so that its kinetic energy becomes four times its original value?

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

(C) $2v$ (D) $4v$

59. People with hearing loss use hearing aid. Which part of the hearing aid converts sound waves to electrical signals?

(A) Microphone

(B) Amplifier

(C) Speaker

(D) Battery

60. A plane mirror and a concave mirror are placed face to face separated by a distance of 8 cm. An object is placed at the mid-point of the two mirrors. The image formed by the plane mirror acts as an object for the concave mirror and the final image formed by the concave mirror is at mid-point of two mirrors and coincides with the original object. The focal length of the concave mirror is

(A) –2 cm

(B) –3 cm

(C) +2 cm

(D) +3 cm

61. A convex lens made of a transparent material of refractive index n_1 is immersed in a liquid of refractive index n_2. Which of the following statements is correct?

(A) The lens will behave as converging lens if $n_1 < n_2$.

(B) The lens will behave as diverging lens if $n_1 > n_2$.

(C) The lens will behave as converging lens if $n_1 > n_2$.

(D) The lens will behave as diverging lens if $n_1 = n_2$.

62. The absolute refractive index of water is 4/3 and of glass is 3/2. The refractive index of glass with respect to water will be

(A) 9/8

(B) 8/9

(C) 7/5

(D) 5/7

63. The defect of vision which arises due to gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens is

(A) hypermetropia

(B) myopia

(C) presbyopia

(D) astigmatism

64. Which of the following phenomena of light are involved in the formation of rainbow in the sky?

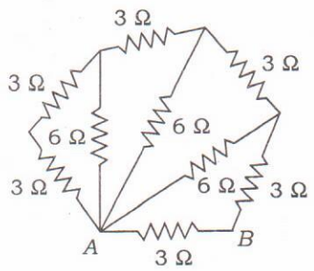
(A) Refraction and total reflection only

(B) Dispersion and refraction only

(C) Dispersion, refraction and scattering

(D) Refraction, dispersion and internal reflection

65. The effective resistance between points A and B in the given figure is



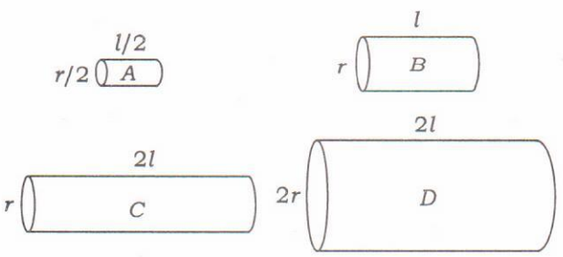
(A) 3 Ω

(B) 9 Ω

(C) 2 Ω

(D) 6 Ω

66. You have four solid tungsten cylinders A, B, C and D of different lengths and radii as shown below. Which two cylinders have same resistance?



(A) A and B

(B) A and C

(C) B and C

(D) B and D

67. In an electrical circuit, two resistors of 2 Ω and 4 Ω respectively are connected in series to a 6 V battery. The heat dissipated by the 4 Ω resistor in 5 s will be

(A) 5 J

(B) 10 J

(C) 20 J

(D) 30 J

68. Consider the following table :

	Causative agent	*Type of disease*
1	Trypanosoma	Kala azar
2	Staphylococci	Acne
3	Nematode	Elephantiasis
4	Leishmania	Sleeping sickness

Which of the above pairs of causative agent and type of disease is/are correct?

(A) 2 only

(B) 3 only

(C) 1 and 4

(D) 2 and 3

69. Which one is the wrong statement?

(A) High blood pressure is caused by excessive weight and lack of exercise.

(B) Cancers can be caused by genetic abnormalities.

(C) Peptic ulcers are caused by eating acidic food.

(D) Acne is caused by Staphylococci.

70. Choose the correct sequence from the following :

(A) Inorganic carbonates in water → organic carbon in plants → organic carbon in animals → scavengers

(B) CO_2 in atmosphere → organic carbon in plants → organic carbon in animals → inorganic carbon in soil

(C) CO_2 in atmosphere → organic carbon in animals → organic carbon in plants → decomposers

(D) Organic carbon in animals → decomposers → CO_2 in atmosphere → organic carbon in plants

71. Ozone layer is getting depleted because of

(A) excessive use of automobiles

(B) excessive formation of industrial units and deforestation

(C) excessive use of man-made carbon compounds containing both fluorine and chlorine

(D) excessive use of pesticides and insecticides

72. In a village, a scientist from IARI pusa advised a farmer not to add nitrogenous fertilizer to his present crop. The reason given by him that the soil fertility had already improved due to the crop which was grown earlier. The earlier grown crop was of

(A) sugarcane

(B) wheat

(C) mustard

(D) pea

73. Which one of the following groups contain items that are least harmful to the environment?

(A) Flowers, wood, disposable paper cups

(B) Leftover food, disposable plastic cups, coal

(C) Cow dung, petrol, coal

(D) Cow dung, solar panels, flowers

74. Consider the following statements about the sustainable development of natural resources :

1. A growth that is acceptable to all the stakeholders.
2. Growth irrespective of the extent of damage caused to the environment.
3. A planned growth keeping minimum damage to the environment in consideration.
4. Not carrying developmental work to conserve the natural resources and the environment.

The correct statement(s) is/are

(A) 1 only

(B) 2 only

(C) 1 and 3 only

(D) 1, 3 and 4 only

75. A national award has been initiated in the memory of Amrita Devi who

(A) pioneered the Chipko Movement in 1970

(B) sacrificed her life for protection of Khejri trees in Khejarli village in 1731

(C) worked relentlessly along with local people to rejuvenate the highly depleted sal forests in Arabari, West Bengal

(D) initiated the project 'Save the Tiger'

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