MODEL SELECTION TEST PAPER – PCMB

Time: 90 minutes   **Total Marks: 60**

Each question carries only one correct choice out of the four given choices and one mark will be awarded for the correct choice made.


PHYSICS

1. A pebble is dropped into a well of depth h. The splash is heard after time t. If c be the velocity of sound, then

   (A) $t = \dfrac{gh^2}{cv^2}$　　　　(B) $t = \dfrac{c+v}{g}$　　　　(C) $t = \dfrac{c-v}{g}$　　　　(D) $t = \sqrt{\dfrac{2h}{g}} + \dfrac{h}{c}$

2. A particle moves so that its acceleration is always twice its velocity. If its initial velocity is 0.1 ms^{-1}, its velocity after it has gone 0.1 m is

   (A) 0.3 m s^{-1}　　　　(B) 0.7 m s^{-1}　　　　(C) 1.2 m s^{-1}　　　　(D) 3.6 m s^{-1}

3. Find the distance travelled in 30 s by an object starting from rest from the information given in the following graph:
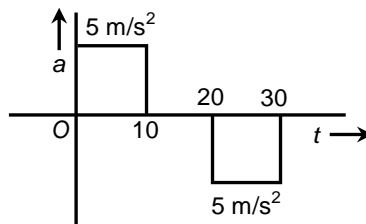
   (A) 500 m   (B) 1000 m

   (C) 250 m   (D) More than one of the above

4. A particle of mass m at rest is acted upon by a constant force F for a time t. its kinetic energy after an interval t is

   (A) $\dfrac{F^2 t^2}{m}$　　　　(B) $\dfrac{F^2 t^2}{2m}$　　　　(C) $\dfrac{F^2 t^2}{3m}$　　　　(D) $\dfrac{Ft}{2m}$

5. Which of the following statement is/are correct regarding momentum?

   (I) It has direction, the same as that of velocity.

   (II) Rate of change of momentum is opposite to the direction of force.

   (III) Change in momentum does not depend on the duration of force applied.

   (IV) Change in momentum takes place on the application of unbalance force only.

   (A) (I)   (B) (III)

   (C) (IV)   (D) More than one of the above

6. A player catches a ball of mass 150 gm moving at a speed of 20 m/s. If the process of catching has to be completed in 0.1 sec, what is magnitude of the impulsive force imparted by the ball to the hands of the player?

    (A) 3000 N   (B) 300 N   (C) 30 N   (D) 0.3 N

7. Consider Earth to be a homogeneous sphere. Scientist A goes deep down in a mine and scientist B goes high up in a balloon. The gravitational field measured by

    (A) each decreases at different rates

    (B) each decreases at the same rate

    (C) B goes on decreasing and that by A goes on increasing

    (D) A goes on decreasing and that by B goes on increasing

8. The radius of earth is about 6400 km and that of mars is 3200 km. The mass of the earth is about 10 times mass of mars. An object weighs 200 N on the surface of earth. Its weight on the surface of mars will be

    (A) 20 N   (B) 8 N   (C) 80 N   (D) 40 N

9. The masses of two planets are in the ratio 1 : 2. Their radii are in the ratio 1 : 2. The acceleration due to gravity on the planets are in the ratio.

    (A) 1 : 2   (B) 2 : 1   (C) 3 : 5   (D) 5 : 3

10. If the mass of a planet is 10% less than that of the Earth and the radius 20% greater than that of the Earth, the acceleration due to gravity on the planet will be

    (A) $\dfrac{5}{8}$ times that on the surface of the Earth   (B) $\dfrac{3}{4}$ times that on the surface of the Earth

    (C) $\dfrac{1}{2}$ times that on the surface of the Earth   (D) $\dfrac{9}{10}$ that on the surface of the Earth

11. An iron sphere of mass 10 kg and an aluminium sphere of mass 3.5 kg, with the same diameter, are simultaneously dropped from a tower. When they are 10 m above the ground, they experience the same:

    (A) Potential energy   (B) Momenta   (C) Acceleration   (D) Kinetic energy

12. Given two objects with masses 1×10^{-3} kg and 4×10^{-3} kg having equal momentum, what is the ratio of their kinetic energies?

    (A) 2:1   (B) 4:1   (C) 1:4   (D) 1:2

13. Two masses of 1 g & 9 g are moving with equal kinetic energies. The ratio of the magnitudes of their respective linear momentum is

    (A) 3:1   (B) 1:3   (C)1:9   (D) 9:1

14. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 m s^{-1}. The kinetic energy of the other mass is

    (A) 324 J   (B) 486 J   (C) 256 J   (D) 524 J

15. The force F acting on a body moving in a circle of radius r is always perpendicular to the instantaneous velocity v. The work done by the force on the body in one complete rotation is

    (A) Fv   (B) F.2πr   (C) Fr   (D) 0

CHEMISTRY

16. The correct set of balancing numbers for the equation $PCl_5 + H_2O \rightarrow H_3PO_4 + HCl$ are

    (A) 1,3,4,5   (B) 1,4,1,3   (C) 1,5,1,4   (D) 1,4,1,5

17. The reaction between nitric oxide and oxygen to give nitrogen dioxide is an example for

    (A) decomposition reaction   (B) oxidation reaction

    (C) combination reaction   (D) both (B) and (C)

18. Which of the following is correct for a reduction reaction?

    (A) addition of oxygen   (B) removal of the electron

    (C) removal of oxygen   (D) both (B) and (C)

19. A silvery white metal burns with a dazzling white flame to give substance A which on reaction with water gives B. Which of these is not correct about B?

    (A) B is partially soluble in water   (B) B is a metal carbonate

    (C) B has a pH above 7   (D) B can be used as antacid

20. Which of these is not a correct combination?

    (A) Methyl orange – red in acidic medium

    (B) Universal indicator- green in neutral medium

    (C) Phenolphthalein – pale pink in acidic medium

    (D) Litmus paper – blue in basic medium

21. Which of these can be used in fire extinguishers?

    (A) Washing soda   (B) Bleaching powder   (C) Caustic soda   (D) Baking soda

22. Which of the following is incorrect about the neutralisation reaction?

    (A) Neutralisation is generally exothermic

    (B) H^+ from acid neutralises OH^- from the base during neutralisation to form water

    (C) All neutralisations result in a neutral pH

    (D) Metal carbonates release carbon dioxide upon neutralisation

23. Farmers neutralise the effect of acidity of the soil by adding

    (A) slaked lime   (B) quick lime   (C) caustic soda   (D) baking soda

24. Which of these is an example of diffusion?

    (A) Sugar dissolving in hot coffee

    (B) Ice cream melts in a warm room

    (C) Pollen from flowers is blown by the wind

    (D) The smell of cooking spreads through a house

25. Butter is an example for which type of colloid?

    (A) liquid in solid   (B) solid in liquid   (C) solid in gas   (D) liquid in liquid

26. The separation technique that can be adopted to get pure water from seawater is

    (A) evaporation   (B) filtration

    (C) simple distillation   (D) fractional distillation

27. Hydrogen combining with oxygen to give water and hydrogen peroxide is an example for

    (A) Law of conservation of mass   (B) Dalton's law

    (C) Law of multiple proportions   (D) Law of definite proportions

28. The number of particles in 0.5 moles of ozone is equal to

    (A) 1.5 x Avogadro number of oxygen atoms   (B) ½ x Avogadro number of ozone molecules

    (C) 3 x Avogadro number of oxygen atoms   (D) both A and B

29. The maximum number of electrons found in any shell 'n' is

    (A) n^2 (B) (n^2-1) (C) $2n^2$ (D) $2(n-1)$

30. **Assertion:** In Rutherford's gold foil experiment 1/3rd of alpha particles are scattered

   Reason: Almost all the atom's mass is concentrated in the nucleus

    (A) Both assertion and reason are true   (B) Assertion is true but reason is false

    (C) Assertion is false but reason is true   (D) Assertion and reason both are false

MATHEMATICS

31. The values of p and q for which the system of equations $2x + 3y = 7$ and $(p+q)x + (2p-q)y = 21$

   has infinitely many solutions, are respectively

    (A) 1, 5   (B) 5, 1   (C) 5, 5   (D) 1, 1

32. The solution of the system of equations $\frac{x}{a} + \frac{y}{b} = 2$ and $ax - by = a^2 - b^2$ is

    (A) -a, b   (B) b, a   (C) a, b   (D) None of these

33. For what value of 't' is $x = \frac{2}{3}$ a solution of $7x^2 + tx - 3 = 0$

    (A) $\frac{55}{6}$ (B) $\frac{6}{55}$ (C) 6   (D) None of these

34. The sides of a right-angled triangle are $(x+6), x, (x+3)$ units then the sides of the triangle are

    (A) 5, 3, 4   (B) 25, 7, 24   (C) 15, 9, 12   (D) 13, 5, 12

35. If α and β are roots of $ax^2 + bx + c = 0$ then the equation whose roots are α^2 and β^2 is

    (A) $cx^2 + bx + a = 0$ (B) $ax^2 + cx + b = 0$

    (C) $a^2x + (2ac - b^2)x + c^2 = 0$ (D) $a^2x^2 + (2ac + b^2)x + c^2 = 0$

36. A rectangular field is 20 m long and 14 m wide. There is a path of equal width all around it, having

   an area of 111 sq m. Find the width of the path.

    (A) $28 m^2$ (B) 2.8 m   (C) 1.5 m   (D) none

37. The coordinates of the points of trisection of the line segment joining (4, - 1) and (- 2, - 3)

    (A) (2, -5/3) & (0, -7/3)   (B) (2, -7/3) & (0, -5/3)

    (C) (2, 0) & (-5/3, -7/3)   (D) (2, 2) & (0, -7/3)

38. The coordinates of two points A and B are $(3, 4)$ and $(5, -2)$, respectively. Then the coordinates of

   the point say P is _____ if $PA = PB$ & the area of ΔPAB is 10 sq. unit.

    (A) $(7, 2)$ or $(-1, 0)$ (B) $(-7, -2)$ or $(-1, 0)$ (C) $(2, 7)$ or $(0, 1)$ (D) None of these\

39. A bag contains white, black and red balls only. A ball is drawn at random from the bag. If the probability of getting a white ball is $3/10$ and that of a black ball is $2/5$ then find the probability of getting a red ball. If the bag contains 20 black balls then find the total number of balls in the bag.

   (A) 35   (B) 50   (C) 40   (D) 30

40. On a morning walk, three persons step off together and their steps measure 40 cm, 42 cm and 45 cm respectively. Then the minimum distance each should walk so that each can cover the same distance and complete steps is

    (A) 2540   (B) 2620   (C) 2520   (D) 2420

41. Let a, b, c, d be positive rationales such that $a + \sqrt{b} = c + \sqrt{d}$, then which of the following is correct
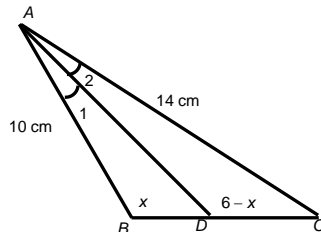
    (A) If $a = c$ then b=d   (B) If $a = c$ then $b \ne d$

    (C) If $a \ne c$ then b=d   (D) None of these

42. In Fig., $DE\|BC$ and $CD\| EF$. Then
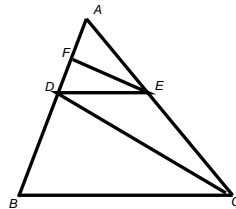
    (A) $AD^2 = AB \times AF$ (B) $AD^2 = AB \times AF$

    (C) $AD^2 = AB \times AF$ (D) $AD^2 = AB \times AF$

43. In Fig., AD is the bisector of $\angle BAC$. If $AB = 10\ cm$. $AC = 14\ cm$ and $BC = 6cm$, then BD is

    (A) $BD = 3.5$ cm   (B) $\Rightarrow BD = 4.5$ cm   (C) $BD = 5.5$ cm   (D) $BD = 2.5$ cm

44. The diagonal BD of a parallelogram $ABCD$ intersects the segment AE at the point F, where E is any point on the side BC. Then

    (A) $ED \times EF = FB \times FA$ (B) $DF \times EF = FB \times FA$

    (C) $CF \times EF = FB \times FA$ (D) None of these

45. If α and β are the zeroes of the quadratic polynomial $f(x) = x^2 - x - 2$, then the polynomial whose zeroes are $2\alpha + 1$ and $2\beta + 1$ is

    (A) $k(x^2 - 4x - 5)$ (B) $k(x^2 + 4x - 5)$ (C) $k(x^2 - 4x + 5)$ (D) None of these

BIOLOGY

46. A researcher intends to test the effects of several growth hormones on the sample plant. Through his experiments following interpretations are listed. Pick the correct interpretation/s according to the functions of specific hormones.
    I.   Cytokinin specially help in delaying senescence
    II. Auxins are involved in regulating apical dominance
    III. Ethylene is especially useful in enhancing seed germination
    IV. Gibberellins are responsible for immature falling of leaves

    (A) I and III   (B) II and I   (C) II and III   (D) I and IV

47. When a neuron is resting, i.e., not conducting any impulse, the axonal membrane is
    (A) impermeable to both Na^+ and K^+ ions
    (B) equally permeable to both Na^+ and K^+ ions
    (C) comparatively more permeable to $Na+$ ions and nearly impermeable to $K+$ ions
    (D) comparatively more permeable to $K+$ ions and nearly impermeable to $Na+$ ions

48. In a laboratory condition, if a cell is treated such that oxygen cannot diffuse into the cell. In this scenario, which of the cell organelles is directly affected?
    (A) Mitochondria   (B) Chloroplast   (C) Golgi body   (D) Lysosome

49. Choose one of the following statements given below which correctly explains the process of osmosis.
    (A) Movement of water from the region of concentrated to dilute solutions
    (B) The passage of solute through a selectively permeable membrane from a region of low solute concentration to a region of high solute concentration.
    (C) The passive transport of solvent through a selectively permeable membrane from a region of low solute concentration to a region of high solute concentration.
    (D) Energy-dependent transport of a solvent through a selectively permeable membrane from a region of low solute concentration to a region of high solute concentration.

50. Given the average duplication time of *E. coli* is 20 minutes, how much time will two *E. coli* cell take to form 1024 daughter cells?
    (A) 120 minutes   (B) 200 minutes   (C) 180 minutes   (D) 160 minutes

51. In green plants, the oxygen evolved comes from
    (A) H_2O (B) CO_2 (C) Atmospheric O_2 (D) Both a and b.

52. From the following statements, choose the correct statement/s.
    I.   All cells do not have a plasma membrane that is selectively permeable
    II. Animal cells contain centrioles but not plant cells
    III. Golgi apparatus which aids in protein folding and packaging is found in plant cells only
    IV. Chloroplast which is the site of photosynthesis is found in plant cells but not in prokaryotic cells
    V.   Mitochondria is present in both animal and plant cells

    (A) I and II   (B) I only   (C) V and III   (D) II and V

53. John has just finished eating a large meal containing rice, bread, and fruit, which are all high in carbohydrates. After the meal, his blood glucose levels rise. Which hormone is primarily responsible for helping his body lower blood glucose levels by allowing his cells to absorb the extra sugar from the bloodstream?

    (A) Glucagon   (B) Adrenaline   (C) Insulin   (D) Thyroxine

54. Unmyelinated nerve fibre is:

    (A) Axon is not surrounded by myelin sheath as the Schwann cells are absent

    (B) Surrounded by a Schwann cell that does not form a myelin sheath.

    (C) Surrounded by oligodendrocytes, not Schwann cells

    (D) This is not found in the autonomous or somatic nervous systems.

55. During a routine check-up, a doctor listens to Emma's heartbeat using a stethoscope. The doctor explains that the first heart sound is caused by the closure of certain valves in her heart. Which of the following describes the source of the first heart sound?

    (A) "Lub" during the closure of semilunar valves

    (B) "Lub" during the closure of atrioventricular valves

    (C) "Dub" during the closure of semilunar valves

    (D) "Dub" during the closure of atrioventricular valves

56. Choose the pair which is the correct match:

(A)	DCT	Glomerulus and Bowman's capsule
(B)	Ultrafiltration	Reabsorption of water
(C)	Henle's Loop	Reabsorption of 70-80% of electrolytes
(D)	PCT	Reabsorption of glucose and amino acids

57. Read the following statements and choose the incorrect statement/s:

    I.   Conduction of water in the xylem is always unidirectional from roots to aerial parts of the plants whereas translocation of the photosynthetic product i.e., starch is translocated by phloem only in the opposite direction as that of xylem.

    II.   Xylem tissue consists of xylem fibres, parenchyma, vessels and tracheids and tracheids do not possess a perforated cell wall

    III.   Systole results in entry of deoxygenated blood into the lungs

    IV.   Diastole results in exit blood from the heart

    (A) I and II   (B) I, II and IV   (C) II and III   (D) I and IV

58. A farmer in India is planning the cultivation of both Kharif and Rabi crops on his farmland. However, he faces challenges related to the unpredictable onset of the monsoon and varying water availability. Given the following crops and their specific growing seasons, which strategy would be the most effective for the farmer to ensure a balanced production cycle throughout the year, while also considering water management?

    (A) Growing wheat during the Kharif season and rice during the Rabi season to manage water resources efficiently.

    (B) Growing maize and mustard together in both Kharif and Rabi seasons to maximize yield.

    (C) Cultivating rice during the Kharif season and wheat during the Rabi season to align with monsoon and winter conditions.

    (D) Planting soybeans during the Rabi season and barley during the Kharif season for balanced water use.

Questions 59 and 60, consist of two statements each: Assertion (A) and reason (R). To answer this question, mark the correct alternative as directed below.

    (A) Both A and R are true and R is the correct explanation of A

    (B) Both A and R are true and R is not the correct explanation of A

    (C) A is true but R is false

    (D) Both A and R are false

59. **Assertion:** Plasmolysis occurs when the plant cells are placed in highly concentrated sugar or salt solution.

    Reason: Highly concentrated sugar or salt solution acts as hypotonic solution which results in exosmosis

60. **Assertion:** During inspiration, the space in the chest cavity increases and the lungs expand

    Reason: Diaphragm contracts and flattens.

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