SECTION : PHYSICS

This section contains **15 Multiple Choice Questions**. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

1. Which of the following pairs does NOT have the same dimensions?
(1) Impulse and momentum
(2) Work and torque
(3) Frequency and angular momentum
(4) Pressure and energy density

2. A projectile is launched at 20 m/s at 60° to the horizontal (g = 10 m/s²). Its maximum height is:
(1) 10 m
(2) 15 m
(3) 20 m
(4) 30 m

3. A 5 kg block on a rough horizontal surface (μ = 0.2) is pulled by a horizontal force of 20 N. Its acceleration is (g = 10 m/s²):
(1) 1 m/s²
(2) 2 m/s²
(3) 3 m/s²
(4) 4 m/s²

4. A pump lifts 600 kg of water per minute from a 10 m deep well and ejects it with negligible speed. Taking 100% efficiency and g = 10 m/s², the power required is:
(1) 600 W
(2) 1000 W
(3) 1500 W
(4) 6000 W

5. A 60 kg man stands at one end of a 120 kg boat of length 6 m floating at rest on still water. He walks to the other end. Ignoring water resistance, the boat moves through:
(1) 1 m
(2) 3 m
(3) 2 m
(4) 4 m

6. A skater spinning with angular velocity ω pulls in her arms so that her moment of inertia becomes half. Her rotational kinetic energy:
(1) becomes half
(2) remains the same
(3) doubles
(4) becomes four times

7. Two planets orbit the same star with orbital radii in the ratio 1 : 4. The ratio of their time periods is:
(1) 1 : 2
(2) 1 : 4
(3) 1 : 8
(4) 1 : 16

8. A soap bubble of radius 2 cm is formed from a solution of surface tension 0.03 N/m. The excess pressure inside the bubble is:

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(1) 1.5 Pa
(2) 3 Pa
(3) 6 Pa
(4) 12 Pa

9. Two moles of a monatomic ideal gas are heated at constant pressure through 10 K. The heat supplied is:
(1) 25R
(2) 20R
(3) 50R
(4) 30R

10. If the pressure of a gas is doubled at constant temperature, its mean free path:
(1) doubles
(2) halves
(3) remains the same
(4) becomes one-fourth

11. A particle in SHM has amplitude 4 cm and time period 2 s. Its speed at a displacement of 2 cm from the mean position is:
(1) 2π cm/s
(2) $2\sqrt{3}\pi$ cm/s
(3) 4π cm/s
(4) $4\sqrt{3}\pi$ cm/s

12. A source of frequency 500 Hz moves towards a stationary observer at 30 m/s. If the speed of sound is 330 m/s, the observer hears a frequency of:
(1) 455 Hz
(2) 550 Hz
(3) 500 Hz
(4) 600 Hz

13. A wire of resistance R is uniformly stretched to three times its original length. Its new resistance is:
(1) 3R
(2) 6R
(3) 9R
(4) R/3

14. A battery of emf 12 V and internal resistance 3 Ω is connected to a variable external resistor. The maximum power delivered to the resistor is:
(1) 6 W
(2) 24 W
(3) 48 W
(4) 12 W

15. A ball is dropped from a height of 20 m onto the floor. If the coefficient of restitution is 0.5, the height reached after the first bounce is:
(1) 10 m
(2) 15 m
(3) 2.5 m
(4)5m

SECTION : CHEMISTRY

This section contains **15 Multiple Choice Questions**. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

16. Which set of quantum numbers is not possible for an electron?
(1) $n = 3, l = 2, m = -2, s = +½$
(2) $n = 2, l = 1, m = 0, s = -½$
(3) $n = 3, l = 3, m = 0, s = +½$
(4) $n = 4, l = 0, m = 0, s = -½$

17. The ground-state electronic configuration of Cr (Z = 24) is

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[Ar] $3d^5\ 4s^1$ and not [Ar] $3d^4\ 4s^2$. The best explanation is:
(1) 4s is always filled after 3d
(2) Half-filled d subshell gives extra stability through symmetry and exchange energy
(3) Pauli exclusion principle forbids $3d^4\ 4s^2$
(4) 4s electrons are closer to the nucleus than 3d electrons

18. Which species has the highest bond order and is also diamagnetic?
(1) O_2
(2) N_2
(3) O_2^-
(4) B_2

19. Which molecule has a zero dipole moment despite containing polar bonds?
(1) NH_3
(2) H_2O
(3) BF_3
(4) NF_3

20. Assertion (A): Ice floats on water.
Reason (R): In ice, water molecules are held in an open cage-like structure by hydrogen bonds, giving it a lower density than liquid water.
(1) Both A and R are true, and R explains A
(2) Both are true, but R does not explain A
(3) A is true, R is false
(4) A is false, R is true

21. For a real gas, the van der Waals constant "a" accounts for _____ and "b" accounts for _____.
(1) molecular volume; intermolecular attraction
(2) intermolecular attraction; finite molecular volume
(3) kinetic energy; pressure
(4) temperature; volume

22. For the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$, $\Delta H = -92$ kJ. Which change will increase both the yield of NH_3 and the equilibrium constant Kc?
(1) Increasing pressure
(2) Increasing temperature
(3) Decreasing temperature
(4) Adding a catalyst

23. A buffer is prepared by mixing equal moles of CH_3COOH and CH_3COONa (pKa = 4.76). On adding a small amount of HCl, the pH:
(1) falls sharply by about 2 units
(2) remains nearly constant because CH_3COO^- neutralises the added H^+
(3) rises because CH_3COOH dissociates more
(4) remains constant because CH_3COOH neutralises the added H^+

24. In the reaction $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 5Fe^{3+} + 4H_2O$, the change in oxidation number of Mn and the number of electrons gained per MnO_4^- are:
(1) +7 to +2; 5 electrons
(2) +7 to +4; 3 electrons
(3) +6 to +2; 4 electrons
(4) +7 to +2; 2 electrons

25. Which statements about the s-block are correct?
I. Lithium shows anomalous behaviour due to its small size and high polarising power.
II. Li_2CO_3 is more stable to heat than Na_2CO_3.
III. $Be(OH)_2$ is amphoteric.
IV. Hardness of water is caused by Ca^{2+} and Mg^{2+} salts.
(1) I, II, III
(2) I, III, IV
(3) II, III, IV
(4) I, II, IV

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26. Which alkene gives only one aldehyde-type product (no ketone) on ozonolysis, and which rule governs the addition of HBr to propene?
(1) Ethene; Markovnikov's rule
(2) 2-Methylpropene; peroxide effect
(3) Ethene; peroxide effect only
(4) Propene; Saytzeff rule

27. Arrange in decreasing order of reactivity towards electrophilic substitution: benzene, nitrobenzene, toluene, phenol.
(1) Phenol > toluene > benzene > nitrobenzene
(2) Toluene > phenol > benzene > nitrobenzene
(3) Nitrobenzene > benzene > toluene > phenol
(4) Phenol > benzene > toluene > nitrobenzene

28. Phenol is a stronger acid than ethanol because:
(1) Phenol has more hydrogen atoms
(2) The phenoxide ion is stabilised by resonance, whereas the ethoxide ion is not
(3) Ethanol forms stronger hydrogen bonds
(4) The O–H bond in ethanol is shorter

29. Which statement about proteins and carbohydrates is incorrect?
(1) Sucrose is a non-reducing sugar
(2) The peptide bond is formed between the –COOH of one amino acid and the $–NH_2$ of another
(3) Denaturation disrupts secondary and tertiary structure but not the primary structure
(4) Cellulose is made of α-D-glucose units and is digestible by humans

30. Among the following, which is correctly matched with its use or property?
(1) Aspirin: antibiotic
(2) Ranitidine: antacid acting by neutralising stomach acid directly
(3) Paracetamol: antipyretic and analgesic
(4) Saccharin: natural sweetener metabolised for energy

SECTION : BIOLOGY

This section contains **20 Multiple Choice Questions**. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

31. Match List I with List II regarding brain structures and functions:

List I (Brain Part)	List II (Primary Function)
(1) Cerebrum	(i) Thermoregulation, hunger, and thirst center
(2) Hypothalamus	(ii) Controls respiration, cardiovascular reflexes, and gastric secretions
(3) Cerebellum	(iii) Seat of intelligence, memory, and voluntary motor control

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(4) Medulla oblongata	(iv) Maintains posture, balance, and coordinates muscular equilibrium

Choose the correct option –

(1) a-(iii), b-(i), c-(iv), d-(ii)

(2) a-(i), b-(ii), c-(iii), d-(iv)

(3) a-(ii), b-(iv), c-(i), d-(iii)

(4) a-(iv), b-(i), c-(iii), d-(ii)

32. Regarding Meiosis, which of the statements is incorrect?
(1) Four haploid cells are formed at the end of Meiosis-II
(2) There are two stages in Meiosis, Meiosis-I and II
(3) DNA replication occurs in S phase of Meiosis-II
(4) Pairing of homologous chromosomes and recombination occurs in Meiosis-I

33. Match List I with List II:

List I (Biomolecule / Component)	List II (Category / Example)
(1) Glutamic acid	(i) Neutral lipid / Fat
(2) Palmitic acid	(ii) Acidic amino acid
(3) Trypsin	(iii) Intercellular / functional protein enzyme
(4) Tyrosine	(iv) Aromatic amino acid

(1) a-(ii), b-(i), c-(iii), d-(iv)

(2) a-(i), b-(ii), c-(iv), d-(iii)

(3) a-(ii), b-(iii), c-(i), d-(iv)

(4) a-(iv), b-(i), c-(iii), d-(ii)

34. Which of the following hormones interacts with intracellular receptors rather than cell-surface membrane receptors?

(1) Insulin

(2) Glucagon

(3) Cortisol

(4) Epinephrine

35. The isobilateral leaf containing large empty colourless cells are present in;
(1) adaxial epidermis of china rose leaf.
(2) abaxial epidermis of banana leaf.
(3) adaxial epidermis of grass leaf.
(4) abaxial epidermis of mustard leaf.

36. Read the following statements regarding urine formation:

I. Reabsorption of water takes place passively in the proximal convoluted tubule (PCT).

II. The descending limb of the loop of Henle is permeable to water but almost impermeable to electrolytes.

III. The distal convoluted tubule (DCT) is capable of reabsorption of $NaHCO_3$ and water.

IV. ANF mechanism acts as a check on the renin-angiotensin mechanism.

How many of the above statements are correct?

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(1) One

(2) Two

(3) Three

(4) Four

37. The following structural features are observed in a transverse section of a part of plant. Arrange them in the correct sequence from outermost to innermost, and identify the correct order:
A. Layer rich in starch grains
B. Semi-lunar patches of sclerenchyma
C. Ring-like arrangement of vascular bundles
D. Collenchymatous tissue as a part of outer cortex
(1) B → D → A → C
(2) D → B → C → A
(3) D → A → B → C
(4) D → B → A → C

38. What is the net gain of ATP when each molecule of glucose is converted to two molecules of pyruvic acid?
(1) Six
(2) Two
(3) Eight
(4) Four

39. Read the following statements:

I. About 20-25 percent of CO_2 is transported as carbaminohemoglobin.

II. Every 100 mL of oxygenated blood delivers around 5 mL of O_2 to the tissues under normal conditions.

III. The diffusion membrane across alveoli is made up of three major cellular layers.

IV. The pneumotaxic center in the pons region of the brain can moderate the functions of the respiratory rhythm center.

How many of the above statements are correct?

(1) One

(2) Two

(3) Three

(4) Four

40. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype/s is/are expected in the progeny?
(1) Only red flowered plants
(2) Red flowered as well as pink flowered plants
(3) Only pink flowered plants
(4) Red, Pink as well as white flowered plants

41. Assertion (A): Consciousness is considered the defining property of all living organisms. Reason (R): All organisms, from the prokaryotes to the most complex eukaryotes, can sense and respond to their environmental cues.
(1) Both A and R are true, and R is the correct explanation of A.
(2) Both A and R are true, but R is not the correct explanation of A.
(3) A is true, but R is false.
(4) A is false, but R is true.

42. . Which of the following is the correct representation of the taxonomic categories of Housefly (Musca domestica)?
(1) Genus: Musca, Family: Muscidae, Order: Primata, Class: Insecta
(2) Genus: Musca, Family: Muscidae, Order: Diptera, Class: Insecta
(3) Genus: Musca, Family: Muscidae, Order: Diptera, Class: Arachnida
(4) Genus: Domestica, Family: Muscidae, Order: Diptera, Class: Insecta

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43. Which of the following sets of animals is correctly matched with its respective excretory structure and phylum?

(1) *Pila* – Metanephridia – Mollusca

(2) *Taenia* – Flame cells – Platyhelminthes

(3) *Culex* – Malpighian corpuscles – Arthropoda

(4) *Asterias* – Proboscis gland – Echinodermata

44. Winged pollen grains are present in:
(1) Mustard
(2) Cycas
(3) Mango
(4) Pinus

45. Find the correct statement:
(1) Families like Solanaceae and Convolvulaceae are included in the order Polymoniales mainly based on floral characters.
(2) The order Carnivora includes families like Felidae and Canidae.
(3) Both 1 and 2 are correct.
(4) Neither 1 nor 2 is correct

46. Neural signals through the sympathetic nerves can increase cardiac output by:

(1) Decreasing the speed of action potential conduction through the AV node

(2) Releasing catecholamines which increase the rate of SA node discharge

(3) Stimulating the vagus nerve to release acetylcholine

(4) Inhibiting ventricular contraction completely

47. The resting axonal membrane is polarized because:

(1) Potassium ions inside are higher, sodium ions outside are higher, and the membrane is impermeable to negatively charged proteins inside.

(2) The sodium-potassium pump actively transports 3 Na+ outwards for every 2 K+ inwards.

(3) Both (1) and (2) are correct.

(4) Calcium channels remain wide open continuously.

48. Assertion (A): In unicellular organisms like Amoeba, reproduction is synonymous with growth.
Reason (R): For unicellular organisms, the increase in the number of cells is the only criterion for both growth and reproduction.
(1) Both A and R are true, and R is the correct explanation of A.
(2) Both A and R are true, but R is not the correct explanation of A.
(3) A is true, but R is false.
(4) A is false, but R is true

49. Match List I with List II regarding human blood cells

List I (WBC Type)	List II (Percentage / Primary Function)
(1) Neutrophils	(i) 2-3%; resist infections and associated with allergic reactions
(2) Eosinophils	(ii) 60-65%; phagocytic cells destroying foreign organisms

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(3) Basophils	(iii) 20-25%; responsible for immune responses (B and T cells)
(4) Lymphocytes	(iv) 0.5-1%; secrete histamine, serotonin, and heparin

Choose the correct option –

(1) a-(ii), b-(i), c-(iv), d-(iii)

(2) a-(i), b-(ii), c-(iii), d-(iv)

(3) a-(iii), b-(iv), c-(i), d-(ii)

(4) a-(iv), b-(iii), c-(ii), d-(i)

50. Match List I with List II regarding brain structures and functions:

List I (Brain Part)	List II (Primary Function)
(1) Cerebrum	(i) Thermoregulation, hunger, and thirst center
(2) Hypothalamus	(ii) Controls respiration, cardiovascular reflexes, and gastric secretions
(3) Cerebellum	(iii) Seat of intelligence, memory, and voluntary motor control
(4) Medulla oblongata	(iv) Maintains posture, balance, and coordinates muscular equilibrium

Choose the correct option –

(1) a-(iii), b-(i), c-(iv), d-(ii)

(2) a-(i), b-(ii), c-(iii), d-(iv)

(3) a-(ii), b-(iv), c-(i), d-(iii)

(4) a-(iv), b-(i), c-(iii), d-(ii)

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