

Biology**Section - I****Straight Objective Type**

Biology contains 90 multiple choice questions numbered 1 to 90. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. The taxonomic unit 'Phylum' in the classification of animals is equivalent to which hierarchical level in classification of plants
(A) Class (B) Order (C) Division (D) Family
2. Fusion between morphologically similar gametes is referred to as
(A) Isogamy (B) anisogamy (C) oogamy (D) apogamy
3. Which of the following is not a characteristic feature of sponges?
(A) Cellular level of organization (B) Presence of ostia
(C) Intracellular digestion (D) Body supported by chitin
4. The suffix '-aceae' is used for
(A) Tribe (B) family (C) class (D) subclass
5. The statements given below shows some characteristics of a phylum. Identify it.
(i) Tissue absent
(ii) internal fertilization
(iii) Development is indirect
(iv) Spongocoel with ostia (many) and single osculum and canal system
(v) Sexes are hermaphrodite
(A) Cnidaria (B) Porifera (C) Platyhelminthes (D) Ctenophora
6. Cyanobacteria are used in agricultural fields for crop improvement because they help in
(A) N₂ fixation (B) CO₂ absorption (C) Respiration (D) all of these
7. Glycocalyx (mucilage sheath) of a bacterial cell may occur in the form of a loose sheath called
(A) Capsomere (B) Slime layer/capsule
(C) Capsid (D) Mesosome
8. National Zoological park is situated at
(A) Delhi (B) Lucknow (C) Jaipur (D) Darjeeling

Space for rough work

-
9. The leaves of gymnosperms are well-adapted to withstand extremes of temperature, humidity, and wind, because of which of the following features?
(A) Needle like leaves (B) Thick cuticle (C) Sunken stomata (D) All of these
10. Which of the following pigments are found in brown algae?
(A) Chl *a*, Chl *c* (B) Chl *a*, Chl *d*
(C) Chl *a*, Chl *c* and fucoxanthin (D) Chl *a*, phycoerythrin
11. In five-kingdom classification system, the kingdom that includes the blue green algae, nitrogen-fixing bacteria, and methanogenic archaeobacteria is
(A) Plantae (B) Fungi (C) Protista (D) Monera
12. Mesosomes are the infolding of cell membrane, Identify the correct functions of mesosomes
(i) are present in both prokaryotic and eukaryotic cells
(ii) Help in cell wall formation, DNA replication, and respiration
(iii) Increase the surface area of plasma membrane
(A) (i) and (ii) (B) (ii) and (iii) (C) (i) and (iii) (D) (i), (ii) and (iii)
13. The bryophytes are usually found in
(A) Damp and shaded areas (B) dry habitat (C) sandy soils (D) xeric habitat
14. System of classification by Linnaeus was based on
(A) Morphology (B) ecology (C) embryology (D) cytology
15. The flightless bird among the following is
(A) Columba (B) Neophron (C) Struthio (D) Corvus
16. At least half of the CO₂ fixation on earth is carried out through photosynthesis by
(A) Angiosperms (B) gymnosperms (C) green algae (D) bryophytes
17. Select the pair that consists of plant or animal bacterial diseases.
(A) Cholera and typhoid (B) Citrus canker and crown gall
(C) Malaria and dengue (D) Both (A) and (B)
18. The type of ribosomes found in prokaryotes is
(A) 80S type (B) 70S type (C) 30S type (D) 50S type
-

Space for rough work

-
19. Which of the following statements regarding Kingdom Plantae is correct?
(A) It includes all eukaryotic chlorophyll containing organisms
(B) Few of its members are partially heterotrophic.
(C) The cell wall is made up of cellulose
(D) All of these
20. The Phylogenetic system of classification was put forth by
(A) Engler & Prantl
(B) Schleiden & Schwann
(C) Hershey & Chase
(D) Lederberg & Tatum
21. Amongst all the kingdom, the only taxon that exists in nature as a biologically cohesive unit is the
(A) Species
(B) genus
(C) phylum or division
(D) kingdom
22. Lipids are arranged within the membrane with
(A) Polar heads toward inner side and the hydrophobic tails toward outer side
(B) Both heads and tails toward outer side
(C) Heads toward outer side and tail towards inside
(D) Both heads and tails toward inner side
23. Agar-agar is commercially obtained from
(A) Green algae
(B) blue-green algae
(C) brown algae
(D) red algae
24. Causal organisms of sleeping sickness and kala-azar belong to which of the following groups of protozoan protists?
(A) Amoeboid protozoans
(B) Flagellated protozoans
(C) Ciliated protozoans
(D) Sporozoans
25. The most abundant lipid in the cell membrane is
(A) Cutin
(B) glycolipid
(C) steroid
(D) phosphoglycerides
26. Resemblances between algae and bryophytes include
(A) Presence of root-like, stem-like, and leaf-like structures
(B) Thallus-like plant body, lack of vascular tissue, autotrophic nutrition
(C) Thallus-like plant body, presence of vascular tissue, autotrophic nutrition
(D) Presence of roots, heterotrophic nutrition
27. Which of the following represents the correct sequence of various taxonomic categories?
(A) Class-Phylum-Tribe-Order-Family-Genus –Species
(B) Division-Class-Family-Tribe-Order-Genus –Species
(C) Kingdom-Phylum-Class- Order -Family -Genus –Species
(D) Phylum-Order-Class-Tribe-Family-Genus-Species
-

Space for rough work

-
28. Dye injected into a plant cell might be able to enter an adjacent cell through
(A) Microtubule (B) microfilament (C) plasmodesmata (D) tight junction
29. Seaweeds are a source of
(A) Chlorine (B) fluorine (C) bromine (D) iodine
30. In the somatic cell cycle
(A) DNA replication takes place in S-phase
(B) In G_1 phase DNA content is double the amount of DNA present in the original cell
(C) A short interphase is followed by a long mitotic phase
(D) G_2 phase follows mitotic phase
31. 'Key' is a taxonomical aid used for the identification of organisms. Each statement in key is called a
(A) couplet (B) lead (C) both a and b (D) none of these
32. If you are provided with root-tips of onion in your class and are asked to count the chromosomes which of the following stages can you most conveniently and clearly Observe the chromosomes?
(A) Interphase (B) Metaphase (C) Prophase (D) Anaphase
33. Virion is
(A) Nucleic acid of virus (B) antiviral agent
(C) Protein of virus (D) completely assembled virus outside host
34. A moss sperm moves by means of
(A) Pseudopodia (B) cilia (C) flagella/tail (D) any of these
35. Amongst the following which one of the following has least similar characters?
(A) Family (B) Class (C) Genus (D) Species
36. Read the following statements and select the incorrect ones
(i) Circulatory system in arthropods is of closed type
(ii) Parapodia in annelids help in swimming
(iii) Phylum Mollusca is the second largest animal phylum
(iv) Aschelminthes are dioecious
(A) I and iii only (B) I only (C) iii only (D) iii and IV only
37. Kingdom Plantae includes
(A) Algae and bryophytes (B) pteridophytes and gymnosperms
(C) Angiosperms (D) all of these
-

Space for rough work

-
38. Which organelle is not a part of endomembrane system?
(A) ER (B) Golgi complex (C) Lysosome (D) Mitochondria
39. Two animals belong to the same kingdom but different classes. They may belong to the same
(A) Phylum (B) order (C) division (D) species
40. Microtubules are absent in
(A) Mitochondria (B) flagella (C) spindle fibres (D) centriole
41. Cup-shaped chloroplast is present in
(A) Spirogyra (B) Chlamydomonas (C) Ulothrix (D) Chara
42. Basic unit or smallest taxon of classification is
(A) Species (B) kingdom (C) family (D) variety
43. Which of the following is an exclusive character of Class Mammalia?
(A) External fertilization (B) Presence of a complete 3-chambered heart
(C) Poikilothermy (D) Presence of muscular diaphragm
44. Mycoplasmas are classified under which of the following kingdoms?
(A) Monera (B) Protista (C) Fungi (D) Plantae
45. Megasporophyll of gymnosperms is homologous to..... of angiosperms
(A) Stamen (B) carpel (C) sepal (D) petal
46. Zygotene of prophase-I characterized by
(A) Chromomeres (B) synaptonemal complex
(C) Crossing over (D) terminalisation of chiasmata
47. Botanical gardens mainly serve the purpose of providing
(A) Beautiful area for recreation (B) reservoir for tropical plants
(C) Ex situ conservation of germplasm (D) natural habitat for wildlife.
48. Which of the following statements is correct for sponges without exception?
(A) They all have pine needles (B) They have high regenerative power
(C) They are found only in marine water (D) they are all radially symmetrical
-

Space for rough work

-
49. Which of the following is not a viral disease of plants?
(A) Red rots of sugarcane (B) Tobacco mosaic disease
(C) Leaf curl of tomato (D) Tristeza disease of citrus
50. The process of crossing over is assisted by which of the following enzymes?
(A) Endonuclease (B) Polymerase (C) Ligase (D) Both A and C
51. With relevance to classification, the name of the Order in the case of plants ends with a suffix?
(A) ...aceae (B) ...ales (C) ...idae (D) ...ae
52. Diplotene stage of prophase-I is characterised by
(A) Dissolution of synaptonemal complex
(B) Separation of synapsed homologous chromosomes except at the site of crossovers
(C) Formation of X-shaped structures called chiasmata
(D) all of these
53. Gemmae are multicellular green structures for vegetative propagation. These are found inside gemma cups in
(A) Riccia Capsule (B) Marchantia thallus (C) Funaria protonema (D) Polytrichum thallus
54. Chrysophytes are
(A) Planktons (B) Viruses (C) Fungi (D) bacteria
55. Crossing over in diploid organisms is responsible for
(A) Dominance of genes (B) linkage between genes
(C) segregation of alleles (D) recombination of alleles
56. Which one of the following organisms is not an example of eukaryotic cells
(A) Amoeba proteus (B) Paramecium caudatum
(C) Escherichia coli (D) Euglena viridis
57. Chromosome duplication without nuclear division refers to
(A) Meiosis (B) mitosis (C) androgenesis (D) endomitosis
58. The embryonic development in bryophytes takes place in the
(A) Protonema (B) sporangium (C) antheridium (D) archegonium
-

Space for rough work

59. Splitting of centromere and hence separation of chromatids occur during
(A) Anaphase of mitosis (B) anaphase of meiosis I
(C) anaphase of meiosis II (D) Both B and C
60. Which of the following statements regarding viruses are correct?
(i) These are cellular, infectious, nucleoprotein particles (ii) They can be grown in culture medium
(iii) Genetic material is either DNA or RNA but never both (iv) They can be crystallized
(A) (i) and (ii) (B) (ii) and (iii) (C) (iii) and (iv) (D) (i), (ii), (iii) and (iv)
61. Which of the following kingdom includes all types of Bacteria?
(A) Monera (B) Protista (C) Fungi (D) None of these
62. If gametes are produced after reduction division, they are termed as
(A) Coenogametes (B) mitogametes (C) pseudogametes (D) meiogametes
63. Phycoerythrin is present in
(A) Euglena (B) Polysiphonia (C) Chlamydomonas (D) Fucus
64. Fungi show asexual reproduction by all of the following kinds of spores except
(A) Conidia (B) oospores (C) sporangiospore (D) zoospores
65. Which of the following structures are haploid in gymnosperms?
(A) Pollen grain, megaspore, embryo (B) Pollen grain, megaspore, endosperm
(C) Megaspore, leaf, root (D) Leaf, root, integument
66. The taxonomic category below the level of family is
(A) Class (B) species (C) phylum (D) genus
67. Among the following organisms which is a completely non-parasitic form?
(A) Sea anemone (B) Tapeworm (C) Leech (D) Mosquito
68. *Funaria* requires water because
(A) Fertilization occurs in water only (B) *Funaria* is a hydrophyte
(C) Plants need water for morphogenesis (D) None of these
69. The ascending or descending arrangement of taxonomic categories is called as
(A) Classification (B) taxonomy (C) hierarchy (D) key

Space for rough work

70. Which one of the following pairs of nitrogenous bases of nucleic acids, is wrongly matched with the category mentioned against it?
(A) Adenine, Thymine – Purines (B) Thymine, Uracil – Pyrimidines
(C) Uracil, Cytosine – Pyrimidines (D) Guanine, Adenine – Purines
71. The kingdom Protista includes all types of
(A) Protozoans (B) Fungi (C) Bacteria (D) Viruses
72. Mechanical support, enzyme circulation, protein synthesis, and detoxification of drugs are the functions of
(A) Dictyosomes (B) chloroplast (C) ribosomes (D) ER
73. Which of these is a correct defining character of plants?
(A) Heterotrophic nature (B) Prokaryotic cell structure
(C) Cellulosic cell wall (D) Anaerobic respiration
74. Which taxonomic aid gives comprehensive account of complete compiled information of a genus or family at a particular time?
(A) Taxonomic key (B) Herbarium (C) Monograph (D) all of these
75. What is a common among crab and honey bee?
(A) Jointed legs (B) Ocelli (C) Nose (D) Poison glands
76. Which of the following is not a moss?
(A) *Polytrichum* (B) *Sphagnum* (C) *Funaria* (D) *Riccia*
77. Red tides in warm coastal water develop due to the abundance of
(A) Dinoflagellates (B) euglenoids (C) diatoms and desmids (D) slime moulds
78.are referred to as vascular cryptogams
(A) Bryophytes (B) Pteridophytes (C) Angiosperms (D) None of these
79. The third name in trinomial nomenclature is
(A) Species (B) subgenus (C) subspecies (D) None of these
80. Two plants can be conclusively said to belong to the same species if they
(A) Have more than 50 percent similar genes
(B) Can reproduce freely with each other and form seeds
(C) Have same number of chromosomes
(D) Look similar and possess identical secondary metabolites

Space for rough work

81. Gemmae are asexual reproductive bodies of
(A) Brown algae (B) mosses (C) liverworts (D) red algae
82. The term 'taxon' is used for
(A) The ranks of species and genus (B) the ranks up to phylum
(C) The species epithet only (D) any rank of taxonomic hierarchy
83. Meiosis does not occur in
(A) Bacteria (B) cyanobacteria (C) plant cell (D) both A and B
84. The 'seaweeds' that form the underwater forest are
(A) Kelps (B) Laminaria (C) Macrocystis (D) all of these
85. Diatomaceous earth is used for all except
(A) Polishing (B) filtration of oils and syrups
(C) Making sound and fire proof rooms (D) biogas production
86. In animals meiotic division occurs during gamete formation. This gametic meiosis results in
(A) Haplontic life cycle (B) diplontic life cycle
(C) Both A & B (D) none of these
87. The term species was coined by _____
(A) Engler (B) Lindemann (C) Aristotle (D) John Ray
88. Laminarin and mannitol, the reserve food of brown algae, are
(A) Lipids (B) complex carbohydrates
(C) proteins (D) lipoproteins
89. Which of the following classes of Kingdom Fungi are characterized by the presence of a large and varied group of fungi that are only known to reproduce by the production of asexual spores (conidia) and in which a sexual form of reproduction is lacking or has not been scientifically observed?
(A) Basidiomycetes (B) Phycomycetes (C) Ascomycetes (D) deuteromycetes
90. At what phase of meiosis there are two cells, each with separated sister chromatids that have been moved to opposite spindle poles?
(A) Anaphase II (B) Anaphase I (C) Metaphase II (D) Metaphase I

Space for rough work

Physics**Section - II****Straight Objective Type**

Physics contains 45 multiple choice questions numbered 1 to 45. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

- A physical quantity 'X' is related to measurable quantities p, q, r, a, b by the following relation:
 $X = a^2 b^3 p^{5/2} q^{3/2} r^4$, the percentage error in the measurement of a, b, p, q, r are 1% ; 2% ; 3% ; 2% ; 1.5%, respectively, what is error in the measurement of 'X' ?
 (A) 24.5% (B) 22.5% (C) 15.5% (D) 20.75%
- A particle travels half the distance with a velocity of 6 m s^{-1} . The remaining half distance is covered with a velocity of 4 m s^{-1} for half the time and with a velocity of 8 m s^{-1} for the rest of the half time. What is the velocity of the particle averaged over the whole time of motion?
 (A) 9 m s^{-1} (B) 6 m s^{-1} (C) 5.35 m s^{-1} (D) 5 m s^{-1}
- A ball is thrown vertically upward with a velocity u from the balloon descending with velocity v . The ball will pass by the balloon after time:
 (A) $\frac{u-v}{2g}$ (B) $\frac{u+v}{2g}$ (C) $\frac{2(u-v)}{g}$ (D) $\frac{2(u+v)}{g}$
- A person is throwing balls vertically upwards. He throws one when the previous one is at its highest point. How high the balls would rise if he throws once in 2 secs?
 (A) 19.6 m (B) 9.8 m (C) 4.9 m (D) 2.45 m
- A boat which has a speed of 5 km h^{-1} in still water crosses a river 1 km wide along the shortest possible path in 15 minutes. The velocity of river water in km h^{-1} is:
 (A) 3 (B) 1 (C) 4 (D) $\sqrt{14}$
- Two equal vectors have a resultant equal to either of them. The angle between them is:
 (A) 60° (B) 90° (C) 100° (D) 120°
- Two projectiles are projected with same speed. If one is projected at an angle 30° and the other at 60° with the horizontal, then the ratio of maximum heights reached is:
 (A) 3: 1 (B) 1: 3 (C) 1: 2 (D) 2: 1

Space for rough work

8. The angle for which maximum height and horizontal range are same for a projectile is:
(A) $\tan^{-1}(1)$ (B) $\tan^{-1}(3)$ (C) $\tan^{-1}(4)$ (D) $\tan^{-1}(2)$
9. A block is allowed to slide down an inclined plane of inclination θ . The inclined plane is lying on floor of a lift which is falling downwards with retardation 'a'. What is the acceleration of the sliding block?
(A) $(g \sin \theta + a)$ (B) $g \sin \theta - a$ (C) $(g + a) \sin \theta$ (D) $(g - a) \sin \theta$
10. A man of mass 90kg is standing in an elevator whose cable broke suddenly. If the elevator falls freely, the force exerted by the floor on the man is ($g = 10 \text{ m s}^{-2}$):
(A) 90 N (B) zero (C) 900 N (D) None of these
11. A block slides down an inclined plane with inclination θ with a constant velocity. It is then projected up the same plane with an initial speed u_0 . How far up the plane will it rise before coming to rest?
(A) $\frac{u_0^2}{4g \sin \theta}$ (B) $\frac{4g \sin \theta}{u_0^2}$ (C) $g \sin \theta$ (D) $\frac{g}{\sin \theta} - u_0^2$
12. A body moves a distance of 10 m along a straight line under the action of a 5 N force. If the work done is 25 J, then angle between the force and direction of motion of the body is
(A) 30° (B) 45° (C) 60° (D) 75°
13. If a particle covers half the circle of radius 'r' with constant speed, then:
(A) Change in angular momentum is $mu r$ (B) change in K.E .is $\frac{1}{2} mu^2$
(C) Change in K.E .is mu^2 (D) change in K.E .is zero
14. The string of a pendulum of mass m and length l is displaced through 90° . Minimum strength of the string to withstand the tension will be:
(A) mg (B) 2 mg (C) 3 mg (D) 4 mg

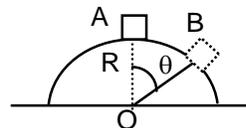
Space for rough work

15. A shell is fired from a canon with velocity $v \text{ m s}^{-1}$ at an angle θ with horizontal. At the maximum height it explodes into two parts of equal masses. One of the pieces retraces its path to the canon. Speed of the second part just after explosion is:

- (A) $3v \cos \theta$ (B) $2v \cos \theta$ (C) $\frac{3}{2} v \cos \theta$ (D) $\frac{\sqrt{3}}{2} v \cos \theta$

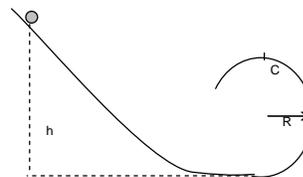
16. A block of mass m starts sliding down the smooth surface of a hemisphere (radius R) and flies off the surface at an angle θ as shown. The work done by the normal reaction during the motion from A to B is

- (A) Zero (B) mgR
(C) $mgR \cos \theta$ (D) $mgR (1 - \cos \theta)$



17. Ball of mass m slides from a fixed inclined plane as shown in the figure. Find the minimum height h so that the ball just completes the circular portion of the surface at C (all surfaces are smooth).

- (A) $h = \frac{5}{2} R$ (B) $h = 2R$
(C) $h = \frac{2}{5} R$ (D) $h = 3R$

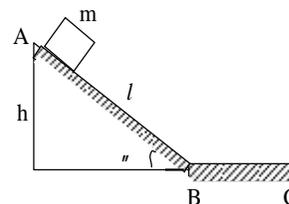


18. If a body is in motion such that only conservative forces are doing work on the body, then which of the following will be conserved

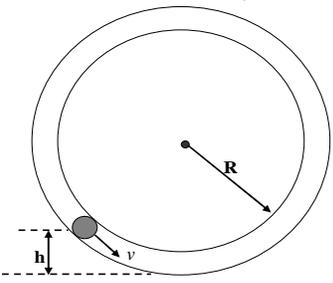
- (A) Total mechanical energy of the body (B) Kinetic energy of the body
(C) Potential energy of the body (D) none of the above

19. A block of mass m starts sliding from rest at the top A of an inclined plane of inclination θ . It slides along AB of length l and then continues sliding on the horizontal surface BC. If the coefficient of friction between all surfaces is μ , calculate the speed when it reaches at the bottom of the inclined plane at point B

- (A) $\sqrt{2gl}$ (B) $\sqrt{2gl \sin \theta}$
(C) $\sqrt{2gl(\sin \theta - \mu \cos \theta)}$ (D) $\sqrt{2gl\mu \cos \theta}$



Space for rough work

20. A spherical ball of mass 20 kg is stationary at the top of a hill of height 100 m. It slides down a smooth surface to the ground, then climbs up another hill of height 30 m and finally slides down to a horizontal base at a height of 20 m above the ground. The velocity attained by the ball is
 (A) 10 m / s (B) $10\sqrt{30}$ m/s (C) 40 m/s (D) 20 m / s
21. A body of mass m accelerates uniformly from rest to v_1 in time t_1 . As a function of time t , the instantaneous power delivered to the body is
 (A) $\frac{mv_1 t}{t_1}$ (B) $\frac{mv_1^2 t}{t_1}$ (C) $\frac{mv_1 t^2}{t_1}$ (D) $\frac{mv_1^2 t}{t_1^2}$
22. With what minimum speed v must a small ball should be pushed inside a smooth vertical tube from a height h so that it may reach the top of the tube? Radius of the tube is R : (Neglect the radius of small ball)
- (A) $\sqrt{2g(h+2R)}$ (B) $\frac{5}{2}R$
 (C) $\sqrt{g(5R-2h)}$ (D) $\sqrt{2g(2R-h)}$
- 
23. The displacement x of a particle moving in one dimension under the action of a constant force is related to the time t by the equation $t = \sqrt{x} + 3$, where x is in meters and t is in seconds. The work done by the force in the first 6 seconds is
 (A) 9 J (B) 6 J (C) 0 J (D) 3 J
24. An engine develops 10 kW of power. How much time will it take to lift a mass of 200 kg to a height of 40 m. ($g = 10\text{m/sec}^2$)
 (A) 4 sec (B) 5 sec (C) 8 sec (D) 10 sec
25. There is a hemispherical bowl of radius R . A block of mass m slides from the rim of the bowl to the bottom. The velocity of the block at the bottom will be:
 (A) \sqrt{Rg} (B) $\sqrt{2Rg}$ (C) $\sqrt{2\pi Rg}$ (D) $\sqrt{\pi Rg}$
26. An athlete completes half a round of a circular track of radius R then the displacement and distance covered by him are
 (A) $2R$ and πR (B) R and $2\pi R$ (C) πR and $2R$ (D) $2\pi R$ and R

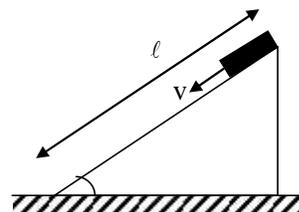
Space for rough work

27. An auto's velocity decreases uniformly from 20 ms^{-1} to 6 ms^{-1} in a distance of 70 m. Then its acceleration is
 (A) -2.6 ms^{-2} (B) -4.2 ms^{-2} (C) 2.6 ms^{-2} (D) 4.2 ms^{-2}
28. A cyclist comes to a skidding stop in 5 m during this process the force on the cycle due to the road is 250 N and is directly opposite to the motion. How much work does the road do on the cycle?
 (A) Zero (B) 1250 J (C) -1250 J (D) None of these
29. A body moves a distance of 10m along a straight line under the action of a force of 5N. If the work done is 25 Joule, the angle which the force makes with the direction of motion of body is
 (A) 0° (B) 30° (C) 60° (D) 90°
30. The total distance covered by a car is 200 m. It covers the first half of the distance at a speed of 40 kmhr^{-1} and the second half of distance at speed v . If its average speed is 48 kmhr^{-1} , the value of v is:
 (A) 52 kmhr^{-1} (B) 60 kmhr^{-1} (C) 48 kmhr^{-1} (D) 65 kmhr^{-1}
31. A monkey of mass 20 kg is holding a vertical rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope ($g = 10 \text{ m/s}^2$)
 (A) 10 m/s^2 (B) 25 m/s^2 (C) 2.5 m/s^2 (D) 5 m/s^2
32. A train 200 m long crosses a bridge 300 m long. It enters the bridge with a speed of 30 ms^{-1} and leaves it with a speed of 50 ms^{-1} . What is the time taken to cross the bridge?
 (A) 2.5 s (B) 7.5 s (C) 12.5 (D) 15.0 s
33. A particle is projected from the ground with an initial speed of 'v' at angle θ with horizontal. The average velocity of the particle between its point of projection and height point of trajectory
 (A) $\frac{v}{2} \sqrt{1 + 2 \cos^2 \theta}$ (B) $\frac{v}{2} \sqrt{1 + \cos^2 \theta}$ (C) $\frac{v}{2} \sqrt{1 + 3 \cos^2 \theta}$ (D) $v \cos^2 \theta$
34. Given, $\vec{\omega} = 2\hat{k}$ and $\vec{r} = 2\hat{i} + 2\hat{j}$. Find the linear velocity
 (A) $4\vec{i} = 4\hat{i} + 2\hat{k}$ (B) $4\hat{i} + 4\hat{k}$ (C) $-4\hat{i} + 4\hat{j}$ (D) $-4\hat{i} - 4\hat{j}$

Space for rough work

35. A wheel rotates about an axle due to the friction of axle it experiences a retardation which is proportional to its angular velocity ω . It completes n revolutions when angular velocity falls to half of the initial value. How many revolutions will it make before coming to rest?
 (A) $2n$ (B) n (C) $n/2$ (D) $n/3$

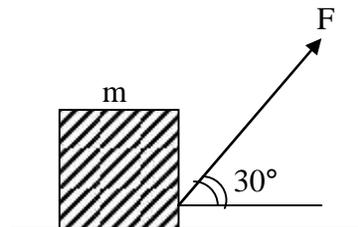
36. A small block is given a velocity v along the inclined in the downward directions at the highest point on an inclined plane, then block moves with constant velocity. After reaching at lowest point, block is given same speed v up the incline. Find time to reach the block again at lowest point. (Assume $v \leq 2\sqrt{g\ell \sin\theta}$)



- (A) $\frac{2\ell}{v}$ (B) $\frac{\ell}{2v}$
 (C) $\frac{\ell}{g \sin\theta}$ (D) It will not return

37. A block has been placed on an inclined plane. The slope angle θ of the plane is such that the block slides down plant at a constant speed. The coefficient of kinetic friction is equal to:
 (A) $\sin\theta$ (B) $\cos\theta$ (C) g (D) $\tan\theta$

38. A mass m rests on a horizontal surface. The coefficient of friction between the mass and the surface is μ . If the mass is pulled by a force F as shown in figure, limiting friction between the mass and the surface will be:



- (A) μmg
 (B) $\mu [mg - (\sqrt{3}/2)F]$
 (C) $\mu [mg - (F/2)]$
 (D) $\mu [mg + (F/2)]$

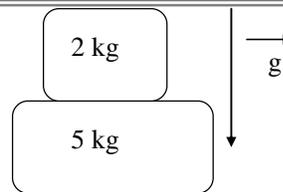
39. A small sphere is suspended by a string from the ceiling of a car. If car begins to move with a constant acceleration a , the inclination of the string to the vertical is:
 (A) $\tan^{-1}(a/g)$ in the direction of motion
 (B) $\tan^{-1}(a/g)$ opposite to the direction of motion
 (C) $\tan^{-1}(g/a)$ in the direction of motion
 (D) $\tan^{-1}(g/a)$ opposite to the direction of motion

Space for rough work

40. A 2 kg is on 5 kg block. The system of blocks falls freely due to gravity as shown. The net force on 5 kg block is:

(Take $g = 10 \text{ m/s}^2$)

- (A) Zero (B) 50 N
(C) 70 N (D) 20 N



41. A body of mass 6 kg is under a force which causes displacement in it given by $S = \frac{1}{4}$ metres where t is time.

The work done by the force in 2 seconds is

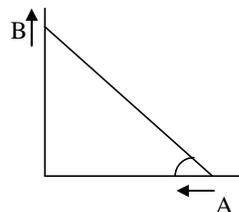
- (A) 12 (B) 9 J (C) 6 J (D) 3 J

42. A stone is tied to a string of length ℓ and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is

- (A) $\sqrt{2g\ell}$ (B) $\sqrt{2(u^2 - g\ell)}$ (C) $\sqrt{u^2 - g\ell}$ (D) $u - \sqrt{u^2 - g\ell}$

43. Two particles A and B are connected by a rigid rod AB. The rod slides along perpendicular rails as shown here. The velocity of A to the left is 10 m/s. What is the velocity of B when angle $\alpha = 60^\circ$?

- (A) 5.8 m/s (B) 9.8 m/s
(C) 10 m / s (D) 17.3 m/s



44. A force $F = (5\hat{i} + 3\hat{j})$ newton is applied over a particle which displaces it from its origin to the point $r = (2\hat{i} - 1\hat{j})$ metres. The work done on the particle is

- (A) -7 joules (B) +13 joules (C) +7 joules (D) +11 joules

45. A body of mass m is moving in a circle of radius r with a constant speed v. The force on the body is $\frac{mv^2}{r}$ and is directed towards the centre. What is the work done by this force in moving the body over half the circumference of the circle

- (A) $\frac{mv^2}{\pi r^2}$ (B) Zero (C) $\frac{mv^2}{r^2}$ (D) $\frac{\pi r^2}{mv^2}$

Space for rough work

Chemistry**Section - III****Straight Objective Type**

Chemistry contains 45 multiple choice questions numbered 1 to 45. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

- The value of Planck's constant is 6.63×10^{-34} JS. The speed of light is 3×10^{17} nms⁻¹, which value is closest to the wavelength in nanometer of a Quantum of light with frequency of 6×10^{15} s⁻¹?
(A) 10 (B) 25 (C) 50 (D) 75
- Which of the following is paramagnetic?
(A) CO (B) O₂⁻ (C) CN⁻ (D) NO⁺
- What is the maximum number of orbitals that can be identified with the following quantum numbers?
n = 3, l = 1, m = 0
(A) 1 (B) 2 (C) 3 (D) 4
- Which of the following species has plane triangular shape?
(A) N₃⁻ (B) NO₃⁻ (C) NO₂⁻ (D) CO₂
- The reaction of aqueous KMnO₄ with H₂O₂ in acidic conditions gives
(A) Mn⁴⁺ and O₂ (B) Mn²⁺ and O₂ (C) Mn²⁺ and O₃ (D) Mn⁴⁺ and MnO₂
- Magnetic moment 2.83 BM is given by which of the following ions? (At no's Ti = 22, Cr = 24, Mn = 25, Ni = 28)
(A) Ti³⁺ (B) Ni²⁺ (C) Cr³⁺ (D) Mn²⁺
- The electronic configurations of Eu (atomic no : 63), Gd (At no : 64), Tb (atomic no : 65) are:
(A) [Xe]4f⁷6s², [Xe]4f⁸6s² and [Xe]4f⁹6s²
(B) [Xe]4f⁶5d¹6s², [Xe]4f⁷5d¹6s² and [Xe]4f⁹5d¹6s²
(C) [Xe]4f⁶5d¹6s², [Xe]4f⁷5d¹6s² and [Xe]4f⁸5d¹6s²
(D) [Xe]4f⁷6s², [Xe]4f⁷5d¹6s² and [Xe]4f⁹6s²
- The product obtains as a result of a reaction of N₂ with CaC₂ is:
(A) CaCN₂ (B) CaCN (C) CaCN₃ (D) Ca₂CN

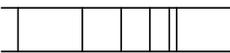
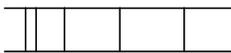
Space for rough work

9. Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does not show oxidizing behaviour?
- (A) $\text{Cu} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$ (B) $3\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$
(C) $\text{C} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + 2\text{SO}_2 + 2\text{H}_2\text{O}$ (D) $\text{CaF}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + 2\text{HF}$
10. Among the following which one is a wrong statement?
- (A) PH_5 and BiCl_5 do not exist (B) p - d bonds are present in SO_2
(C) SeF_4 and CH_4 have same shape (D) I_3^+ has bent shape
11. A thin balloon filled with air at 47°C has a volume of 3 litre. If on placing it in a cooled room its volume becomes 2.7 litre, the temperature of room is :
- (A) 42°C (B) 100°C (C) 15°C (D) 200°C
12. Which one of the following statements regarding helium is incorrect ?
- (A) It is used to fill gas balloons instead of hydrogen because it is lighter and non-inflammable
(B) It is used as a cryogenic agent for carrying out experiments at low temperatures
(C) It is used to produce and sustain powerful superconducting magnets
(D) It is used in gas-cooled nuclear reactors
13. On the surface of the earth at 1 atm pressure, a balloon filled with H_2 gas occupies 500 mL. This volume is $\frac{5}{6}$ of its maximum capacity. The balloon is left in air. It starts rising. The height above which the balloon will burst if temperature of the atmosphere remains constant and the pressure decreases 1 mm for every 100 cm rise of height is
- (A) 120 m (B) 136.67 m (C) 126.67 m (D) 100 m
14. A chemist has synthesized a greenish yellow gaseous compound of chlorine and oxygen and finds that its density is 7.71 g/L at 36°C and 2.88 atm. Then the molecular formula of the compound will be
- (A) ClO_3 (B) ClO_2 (C) ClO (D) Cl_2O_2
15. A gas with formula $\text{C}_n\text{H}_{2n+2}$ diffuses through the porous plug at a rate one sixth of the rate of diffusion of hydrogen gas under similar conditions. The formula of gas is –
- (A) C_2H_6 (B) $\text{C}_{10}\text{H}_{22}$ (C) C_5H_{12} (D) C_6H_{14}
16. A balloon filled with methane (CH_4) is pricked with a sharp point and quickly plunged into a tank of hydrogen at the same pressure. After sometime, the balloon would have
- (A) Enlarged (B) Shrank
(C) Remain unchanged in size (D) Completely collapsed

Space for rough work

17. If 250 ml of 0.25 M NaCl solution is diluted with water to a volume of 500 ml, the new concentration of the solution is -
(A) 0.167 M (B) 0.125 M (C) 0.0833 M (D) 0.0167 M
18. The oxidation state of Cr in $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]^+$ is:
(A) +3 (B) +2 (C) +1 (D) 0
19. When KMnO_4 acts as an oxidising agent and ultimately forms K_2MnO_4 , MnO_2 , Mn_2O_3 and Mn^{2+} , then the number of electrons transferred in each case is :
(A) 4, 3, 1, 5 (B) 1, 5, 3, 7 (C) 1, 3, 4, 5 (D) 3, 5, 7, 1
20. The normality of 0.3 M phosphorus acid (H_3PO_3) is :
(A) 0.1 (B) 0.9 (C) 0.3 (D) 0.6
21. Pick out the isoelectronic species from the following
(I) $^+\text{CH}_3$ (II) H_3O^+ (III) NH_3 (IV) CH_3^-
(A) I and II (B) III and IV (C) I and III (D) II, III and IV
22. Which of the following oxide is neutral?
(A) CO (B) SnO_2 (C) ZnO (D) SiO_2
23. A teacher enters a class room from front door while student from back door. There are 13 equidistant rows of benches in the classroom. The teacher releases N_2O , the laughing gas, from the first bench while the student releases the weeping gas ($\text{C}_6\text{H}_{11}\text{OBr}$) from the last bench. At which row will the students starts laughing and weeping simultaneously.
(A) 7 (B) 10 (C) 9 (D) 8
24. The correct order of acid strength is :
(A) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{SO}_2 < \text{P}_2\text{O}_3$ (B) $\text{SiO}_2 < \text{SO}_2 < \text{Al}_2\text{O}_3 < \text{P}_2\text{O}_3$
(C) $\text{SO}_2 < \text{P}_2\text{O}_3 < \text{SiO}_2 < \text{Al}_2\text{O}_3$ (D) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{P}_2\text{O}_3 < \text{SO}_2$
25. The incorrect statement among the following is:
(A) the first ionisation potential of Al is less than the first ionisation potential of Mg
(B) the second ionisation potential of Mg is greater that the second ionisation potential of Na
(C) the first ionisation potential of Na is less than the first ionisation potential of Mg
(D) the third ionisation potential of Mg is greater than the third ionisation potential of Al
26. Based on lattice energy and other considerations, which one of the following alkali metal chlorides is expected to have the highest melting point ?
(A) LiCl (B) NaCl (C) KCl (D) RbCl

Space for rough work

27. As the tendency to form p - d bond decreases the tendency for the polymerisation increases. So the correct order of tendency of polymerisation is :
- (A) $\text{SiO}_4^{4-} < \text{PO}_4^{3-} < \text{SO}_4^{2-} < \text{ClO}_4^-$ (B) $\text{PO}_4^{3-} < \text{SiO}_4^{4-} < \text{SO}_4^{2-} < \text{ClO}_4^-$
 (C) $\text{ClO}_4^- < \text{SO}_4^{2-} < \text{SiO}_4^{4-} < \text{PO}_4^{3-}$ (D) $\text{SiO}_4^{4-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{ClO}_4^-$
28. The structure of diborane (B_2H_6) contains :
- (A) four 2c–2e bonds and four 3c–2e bonds (B) two 2c–2e bonds and two 3c–3e bonds
 (C) two 2c–2e bonds and four 3c–2e bonds (D) four 2c–2e bonds and two 3c–2e bonds
29. Among (i) $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, (ii) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, (iii) $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, and (iv) $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$, isomorphous salts are
- (A) (i) and (ii) (B) (i) and (iv) (C) (i) and (iii) (D) (iii) and (ii)
30. The number of significant figures for the three numbers 161 cm, 0.161 cm, 0.0161 cm is
- (A) 3, 3, and 4, respectively (B) 3, 4, and 4, respectively
 (C) 3, 3, and 3, respectively (D) 3, 4, and 5, respectively
31. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter-orbit jumps of the electrons for the Bohr orbits in an atom of hydrogen?
- (A) $3 \rightarrow 2$ (B) $4 \rightarrow 1$ (C) $2 \rightarrow 5$ (D) $5 \rightarrow 2$
32. The number of lone pair(s) of electrons in XeOF_4 is:
- (A) 3 (B) 2 (C) 1 (D) 4
33. Which diagram best represents the appearance of the line spectrum of atomic hydrogen in the visible region?
- (A)  (B) 
 (C)  (D) 
34. In an atom, an electron is moving with a speed of 600 ms^{-1} with an accuracy of 0.005%. Certainty with which the position of the electron can be located is ($m_e = 9.1 \times 10^{-31} \text{ kg}$, $h = 6.6 \times 10^{-34} \text{ kgm}^2\text{s}^{-1}$)
- (A) $1.93 \times 10^{-3} \text{ m}$ (B) $3.84 \times 10^{-3} \text{ m}$ (C) $5.10 \times 10^{-3} \text{ m}$ (D) $1.52 \times 10^{-4} \text{ m}$
35. Which of the following statements is not correct for the periodic classification of elements?
- (A) For transition elements, the d subshells are filled with electrons monotonically with the increase in atomic number
 (B) The first ionization energies of elements along a period do not vary in a regular manner with the increase in atomic number
 (C) Nonmetallic elements are lesser in number than metallic elements.
 (D) The properties of elements are the periodic functions of their atomic numbers

Space for rough work

36. Which of the following sets of atomic numbers belongs to that of alkali metals?
(A) 1, 12, 30, 4, 62 (B) 37, 19, 3, 55 (C) 9, 17, 35, 53 (D) 12, 20, 56, 88
37. The number of sigma bonds in P_4O_{10} is
(A) 16 (B) 17 (C) 7 (D) 6
38. The number of water molecules directly bonded to the metal center in $CuSO_4 \cdot 5H_2O$ is
(A) 2 (B) 3 (C) 4 (D) 5
39. The enolic form of butanone contains:
(A) 12 bonds, 1 bond, and 2 lone pairs of electrons
(B) 11 bonds, 1 bond, and 2 lone pairs of electrons
(C) 12 bonds, 1 bond, and 1 lone pairs of electrons
(D) 10 bonds, 2 bond, and 2 lone pairs of electrons
(E) 13 bonds, 1 bond, and 2 lone pairs of electrons
40. Dominance of strong repulsive forces among the molecules of the gas (Z = compressibility factor)
(A) depends on Z and is indicated by $Z = 1$ (B) depends on Z and is indicated by $Z > 1$
(C) depends on Z and is indicated by $Z < 1$ (D) is independent of Z
41. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends. The white ammonium chloride ring first formed will be
(A) at the center of the tube (B) near the hydrogen chloride bottle
(C) near the ammonia bottle (D) throughout the length of the tube
42. Two gas bulbs A and B are connected by a tube having a stopcock. Bulb A has a volume of 100 mL and contains H_2 gas. After opening the gas from A to the evacuated bulb B, the pressure falls down by 40%. The volume (mL) of B must be
(A) 200 (B) 125 (C) 66 (D) 75
43. In van der Waals equation of state, the constant b is a measure of
(A) intermolecular attraction (B) volume occupied by the molecules
(C) intermolecular repulsion (D) intermolecular collisions per unit volume
44. In which of the following has the oxidation number of oxygen been arranged in increasing order?
(A) $KO_2 < OF_2 < O_3 < BaO_2$ (B) $BaO_2 < KO_2 < O_3 < OF_2$
(C) $BaO_2 < O_3 < O_2 < KO_2$ (D) $OF_2 < KO_2 < BaO_2 < O_3$
45. What products are expected from the disproportionation reaction of hypochlorous acid?
(A) $HClO_2$ and $HClO_4$ (B) $HClO_3$ and Cl_2O (C) HCl and Cl_2O (D) HCl and $HClO_3$

Space for rough work