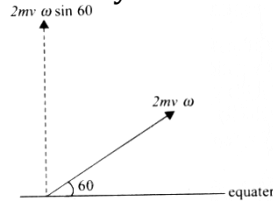


SECTION- A

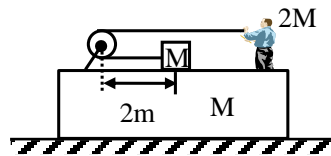
1. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by a relation $f = am^xk^y$, where a is a dimensionless constant. The values of x and y are
- (a) $x = \frac{1}{2}, y = \frac{1}{2}$ (b) $x = -\frac{1}{2}, y = -\frac{1}{2}$
(c) $x = \frac{1}{2}, y = -\frac{1}{2}$ (d) $x = -\frac{1}{2}, y = \frac{1}{2}$.
2. If a boat can have a speed of 4 km/hr in still water, for what values of speed of river flow, it can be managed to row boat right across the river, without any drift?
- (a) ≥ 4 km/hr
(b) Greater than zero but less than 4 km/hr
(c) Only 4 km /hr
(d) None of these
3. A car is travelling at a velocity of 10 kmh^{-1} on a straight road. The driver of car throws a parcel with a velocity of $10\sqrt{2} \text{ kmh}^{-1}$ when car is passing by a man standing on the side of a road. If parcel just reaches the man, the direction of throw makes following angle with the direction of car
- (a) 135° (b) 45° (c) $\tan^{-1}(\sqrt{2})$ (d) $\tan^{-1}(1/\sqrt{2})$
4. Which of the following ideas is helpful in understanding projectile motion?
- (a) $v_x^2 + v_y^2 = \text{constant}$
(b) Acceleration is $+g$ when the object is rising and $-g$ when falling
(c) In the absence of friction, the trajectory will depend on the object's mass as well as its initial velocity and launch angle
(d) The horizontal motion is independent of the vertical motion
5. The upper half of an inclined plane of inclination θ is perfectly smooth while the lower half is rough. A body starting from the rest at top comes back to rest at the bottom if the coefficient of friction for the lower half is given
- (a) $\mu = \sin \theta$ (b) $\mu = \cot \theta$
(c) $\mu = 2 \cos \theta$ (d) $\mu = 2 \tan \theta$

Space for rough work

6. A train of 2000 tone moves in the latitude 60° North. Find the magnitude of the lateral force that the train exerts on the rails if it moves with a velocity 54 km h^{-1} .



- (a) $2.4 \times 10^3 \text{ N}$ (b) $3.6 \times 10^4 \text{ N}$
 (c) $3.6 \times 10^3 \text{ N}$ (d) $2.4 \times 10^4 \text{ N}$
7. A 500 g ball is released from a height of 4 m. Each time it makes contact with the ground it loses 25% of its energy. Find the KE it possesses after 3rd hit:
- (a) 15 J (b) 11.25 J (c) 8.44 J (d) None of these
8. A block of mass M is tied to one end of a massless rope. The other end of the rope is in the hands of a man of mass $2M$ as shown in the figure. The block and the man are resting on a rough wedge of mass M as shown in the figure. The whole system is resting on a smooth horizontal surface. The man pulls the rope. Pulley is massless and frictionless. What is the displacement of the wedge when the block meets the pulley?



- (a) 0.5 m (b) 1 m (c) Zero (d) $2/3 \text{ m}$
9. The escape velocity of a body on the surface of the earth is 11.2 km/s . If the earth's mass increases to twice its present value and radius of the earth becomes half, the escape velocity becomes -
- (a) 5.6 km/s (b) 11.2 km/s
 (c) 22.4 km/s (d) 44.8 km/s

Space for rough work

10. The value of g on the surface of earth is 9.8 m/s^2 & the radius of earth is 6400 km . The avg. density of earth in kg/m^3 will be -

- (a) 5.29×10^3 (b) 2.64×10^3
 (c) 7.60×10^3 (d) 1.46×10^3

11. The ratio of the lengths of two wires A and B of same material is $1 : 2$ and the ratio of their diameter is $2 : 1$. They are stretched by the same force, then the ratio of increase in length will be

- (a) $2 : 1$ (b) $1 : 4$
 (c) $1 : 8$ (d) $8 : 1$

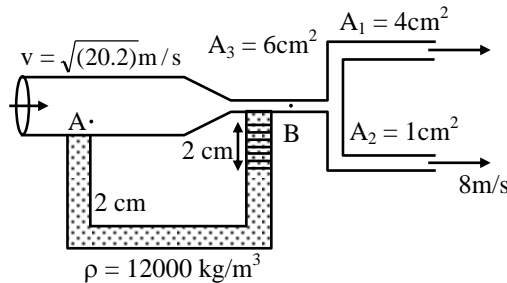
12. The length of a wire is 1.0 m and the area of cross-section is $1.0 \times 10^{-2} \text{ cm}^2$. If the work done for increase in length by 0.2 cm is 0.4 joule , then Young's modulus of the material of the wire is

- (a) $2.0 \times 10^{10} \text{ N/m}^2$ (b) $4 \times 10^{10} \text{ N/m}^2$
 (c) $2.0 \times 10^{11} \text{ N/m}^2$ (d) $2 \times 10^{10} \text{ N/m}^2$

13. A cubical vessel open from top of side L is filled with a liquid of density ρ then the torque of hydrostatic force on a side wall about an axis passing through one of bottom edges is-

- (a) $\frac{\rho g L^4}{4}$ (b) $\frac{\rho g L^4}{6}$ (c) $\frac{2\rho g L^4}{3}$ (d) $\frac{\rho g L^4}{3}$

14. Calculate the velocity with which the liquid gushes out of the 4 cm^2 outlet, if the liquid flowing in the tube is water and liquid in U tube has a specific gravity 12. Velocity of liquid at point A is $\sqrt{20.2} \text{ m/s}$ -



- (a) 2.5 m/s (b) 5.5 m/s (c) 8 m/s (d) 10 m/s

Space for rough work

15. 5 g of ice at 0°C is dropped in a beaker containing 20 g of water at 40°C . The final temperature will be

- (a) 32°C (b) 16°C
(c) 8°C (d) 24°C

16. An ideal gas whose adiabatic exponent is γ is expanded so that the amount of heat transferred to the gas is equal to the decrease of its internal energy. Molar heat capacity of the gas for this process is -

- (a) $\frac{R}{1-\gamma}$ (b) $\frac{R}{\gamma-1}$ (c) R (d) $R/2$

17. An ideal gas at (P,V,T) is expanding adiabatically to 5.66 times the volume and half the temperature. The degree of freedom f of the gas and work done W by the gas -

- (a) $W = 0, f = 5$ (b) $W = PV, f = 7$
(c) $W = \frac{25}{23} P, f = 7$ (d) $W = \frac{25}{23} PV, f = 5$

18. Two spheres made of same material have radii in the ratio 1: 2. Both are at same temperature. Ratio of heat radiation energy emitted per second by them is

- (a) 1: 2 (b) 1: 8 (c) 1: 4 (d) 1: 16

19. A body takes T minutes to cool from 62°C to 61°C when the surrounding temperature is 30°C . The time taken by the body to cool from 46°C to 45.5°C is

- (a) Greater than T minutes (b) Equal to T minutes
(c) Less than T minutes (d) Equal to T/2 minutes

20. A $1.00 \times 10^{-20} \text{ kg}$ particle is vibrating with simple harmonic motion with a period of $1.00 \times 10^{-5} \text{ sec}$ and a maximum speed of $1.00 \times 10^3 \text{ m/s}$. The maximum displacement of the particle is

- (a) 1.59 mm (b) 1.00 m
(c) 10 m (d) None of these

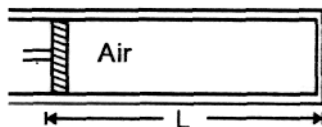
21. A particle executes simple harmonic motion along a straight line with an amplitude A . The potential energy is maximum when the displacement is

- (a) $\pm A$ (b) Zero
 (c) $\pm \frac{A}{2}$ (d) $\pm \frac{A}{\sqrt{2}}$

22. A plane wave is represented by $x = 1.2 \sin (314 t + 12.56 y)$ where x and y are distances measured along in x and y direction in meter and t is time in seconds. This wave has

- (a) A wave length of 0.25 m and travels in +ve x -direction
 (b) A wavelength of 0.25 m and travels in +ve y -direction
 (c) A wavelength of 0.5 m and travels in -ve y -direction
 (d) A wavelength of 0.5 m and travels in -ve x -direction

23. Air confined to a tube closed at both ends with movable piston at one of the ends is used to produce standing sound waves inside. If V is speed of sound in air inside and L is length of the tube then condition for resonant frequencies v_n is:



- (a) $v_n = \frac{nV}{2L}$, $n = 1, 2, 3, \dots$
 (b) $v_n = \frac{nV}{4L}$, $n = 1, 3, 5, \dots$
 (c) $v_n = \frac{nV}{8L}$, $n = 1, 5, 9, \dots$
 (d) A tube closed at both ends does not have any resonant frequencies

24. Eight charges, each of the magnitude q are placed at the vertices of a cube placed in vacuum. Electric potential at the centre of the cube due to this system of charges is -

(ϵ_0 is permittivity of vacuum and a is length of each side of the cube)

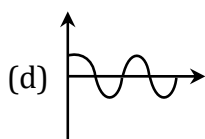
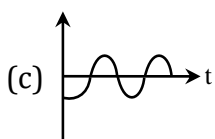
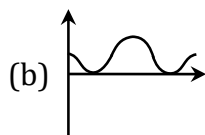
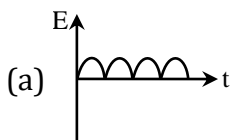
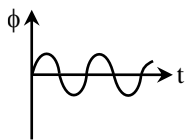
- (a) $\frac{2q}{\pi\epsilon_0 a}$ (b) $\frac{4q}{\sqrt{3}\pi\epsilon_0 a}$ (c) Zero (d) $\frac{\sqrt{3}q}{\pi\epsilon_0 a}$

Space for rough work

25. Charge of + 1 esu, + 2 esu and +3 esu are placed at the three corners of a square. What charge should be placed at the fourth corner so that potential at the centre may be zero? One side of the square is $\sqrt{2}$ cm.
(a) + 6 esu (b) – 6 esu (c) + 4 esu (d) – 4 esu
26. Equal potentials are applied on an iron and copper wire of same length. In order to have same current flow in the wire, the ratio $\left(\frac{r_{iron}}{r_{copper}}\right)$ of their radii must be [Given that specific resistance of iron = $1.0 \times 10^{-7}\Omega m$ and that of copper = $1.7 \times 10^{-8}\Omega m$]
(a) About 1.2 (b) About 2.4
(c) About 3.6 (d) About 4.8
27. A potentiometer has uniform potential gradient across it. Two cells connected in series (i) to support each other and (ii) to oppose each other are balanced over 6 m and 2 m respectively on the potentiometer wire. The emf's of the cells are in the ratio of
(a) 1: 2 (b) 1: 1 (c) 3: 1 (d) 2: 1
28. Forty electric bulbs are connected in series across a 220 V supply. After one bulb is fused, the remaining 39 are connected again in series across the same supply. The illumination will be
(a) More with 40 bulbs than with 39
(b) More with 39 bulbs than with 40
(c) Equal in both the cases
(d) In the ratio of $40^2: 39^2$
29. The ratio of thermal capacities of two spheres A and B, if their diameters are in the ratio 1: 2, densities in the ratio 2: 1, and the specific heat in the ratio of 1: 3, will be -
(a) 1: 6 (b) 1: 12 (c) 1: 3 (d) 1: 4
30. A particle of charge -16×10^{-18} coulomb moving with velocity 10 m/s along the x-axis enters a region where a magnetic field of induction B is along the y-axis, and an electric field of magnitude 10^4 V/m is along the negative z-axis. If the charged particle continuous moving along the x-axis, the magnitude of B is
(a) 10^{-3} Wb/m² (b) 10^3 Wb/m²
(c) 10^5 Wb/m² (d) 10^{16} Wb/m²

Space for rough work

31. A long straight wire carrying a current of 30 A is placed in an external uniform magnetic field of induction 4×10^{-4} T. The magnetic field is acting parallel to the direction of current. The magnitude of the resultant magnetic induction in tesla at a point 2.0 cm away from the wire is -
 (a) 10^{-4} (b) 3×10^{-4} (c) 5×10^{-4} (d) 6×10^{-4}
32. The magnetic field at a point X on the axis of a small bar magnet is equal to the field at a point Y on the equator of the same magnet. The ratio of the distance of X and Y from the centre of the magnet is
 (a) 2^{-3} (b) $2^{-1/3}$ (c) 2^3 (d) $2^{1/3}$
33. A magnet is suspended in such a way that it oscillates in the horizontal plane. It makes 20 oscillations per minute at a place where dip angle is 30° and 15 oscillations per minute at a place where dip angle is 60° . The ratio of total earth's magnetic field at the two places is
 (a) $3\sqrt{3} : 8$ (b) $16 : 9\sqrt{3}$ (c) 4 : 9 (d) $2\sqrt{3} : 9$
34. The coefficient of self-inductance of a solenoid is 0.18 mH. If a core of soft iron of relative permeability 900 is inserted, then the coefficient of self-inductance will become nearly
 (a) 5.4 Mh (b) 162 Mh
 (c) 0.006 mh (d) 0.0002 Mh
35. The magnetic flux through a coil varies with time t as shown in diagram. Which graph best represents the variation of the emf E induced in the coil?



Space for rough work

Section -B

36. If the frequency of ac is 60 Hz the time difference corresponding to a phase difference of 60° is

- (a) 60 sec (b) 1sec (c) $\frac{1}{60}$ sec (d) $\frac{1}{360}$ sec

37. If resistance of 100Ω and inductance of 0.5 henry and capacitance of 10×10^6 farad are connected in series through 50 Hz A.C. supply, then impedance is -

- (a) 1.8765Ω (b) 18.76Ω (c) 187.6Ω (d) 101.3Ω

38. While doing his experiment, Millikan one day observed the following charges on a single drop

(i) $6.563 \times 10^{-19} C$ (ii) $8.204 \times 10^{-19} C$

(iii) $11.50 \times 10^{-19} C$ (iv) $13.13 \times 10^{-19} C$

(v) $16.48 \times 10^{-19} C$ (vi) $18.09 \times 10^{-19} C$

From this data the value of the elementary charge (e) was found to be

(a) $1.641 \times 10^{-19} C$ (b) $1.630 \times 10^{-19} C$

(c) $1.648 \times 10^{-19} C$ (d) $1.602 \times 10^{-19} C$

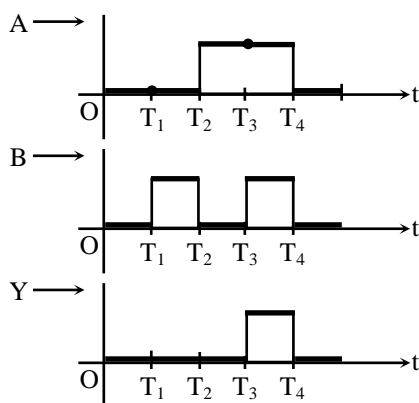
39. The work function of metal is 1 eV. Light of wavelength 3000 \AA is incident on this metal surface. The velocity of emitted photo-electrons will be

(a) 10 m/sec (b) 1×10^3 m/sec

(c) 1×10^4 m/sec (d) 1×10^6 m/sec

Space for rough work

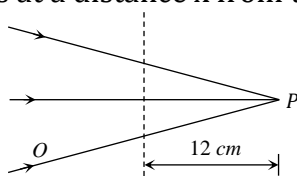
40. In Bohr model of hydrogen atom, the ratio of periods of revolution of an electron in $n = 2$ and $n = 1$ orbits is
 (a) 2: 1 (b) 4: 1 (c) 8: 1 (d) 16: 1
41. If 13.6 eV energy is required to ionize the hydrogen atom, then the energy required to remove an electron from $n = 2$ is -
 (a) 10.2 eV (b) 0 (c) 3.4 eV (d) 6.8 eV
42. The transfer ratio of a transistor is 50. The input resistance of the transistor when used in the common-emitter configuration is 1 K Ω . The peak value for an ac input voltage of 0.01 V peak is
 (a) 100 μ A (b) 0.01 Ma (c) 0.25 mA (d) 500 μ A
43. Rectifier is used to convert -
 (a) Electrical energy into mechanical energy
 (b) Heat energy into electrical energy
 (c) High voltage into low voltage
 (d) AC into DC
44. A T.V. tower has a height of 100 m. How much population is covered by T.V. broadcast, if the average population density around the tower is 1000/ km²?
 (a) 39.5×10^5 (b) 19.5×10^6
 (c) 29.5×10^7 (d) 9×10^4
45. The given figure shows the waveforms for two inputs A and B and that for the output Y of a logic circuit. The logic circuit is -



- (a) An AND gate (b) An OR gate
 (c) A NAND gate (d) A NOT gate

Space for rough work

46. Figure given below shows a beam of light converging at point P. When a concave lens of focal length 16 cm is introduced in the path of the beam at a place O shown by dotted line such that OP becomes the axis of the lens, the beam converges at a distance x from the lens. The value x will be equal to



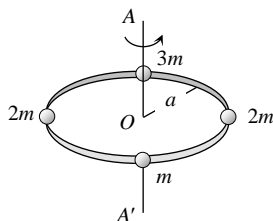
- (a) 12 cm (b) 24 cm (c) 36 cm (d) 48 cm
47. A ray enters a glass sphere of R. I. $n = \sqrt{3}$ at an angle of incidence 60° and is reflected and refracted at the farther surface of the sphere. The angle between the reflected and refracted rays at this surface is
- (a) 50° (b) 60° (c) 90° (d) 40°

48. If two waves represented by $y_1 = 4 \sin \omega t$ and

$y_2 = 3 \sin\left(\omega t + \frac{\pi}{3}\right)$ interfere at a point, the amplitude of the resulting wave will be about

- (a) 7 (b) 6 (c) 5 (d) 3.
49. Two identical sources emitted waves which produces intensity of k unit at a point on screen where path difference is λ . What will be intensity at a point on screen at which path difference is $\lambda/4$
- (a) $\frac{k}{4}$ (b) $\frac{k}{2}$ (c) k (d) Zero

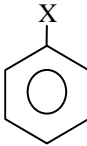
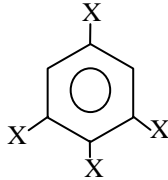
50. Four masses are joined to a light circular frame as shown in the figure. The radius of gyration of this system about an axis passing through the centre of the circular frame and perpendicular to its plane would be



- (a) $a/\sqrt{2}$ (b) $a/2$ (c) a (d) $2a$

Space for rough work

Section - A

1. 25 mL of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous NaOH solution?
 (a) 25 mL (b) 75 mL (c) 50 mL (d) 12.5 mL
2. 0.6 g of urea on strong heating with NaOH evolves NH_3 . Liberated NH_3 will combine completely with which of the following HCl solution?
 (a) 100 mL of 0.2NHCl (b) 400 mL of 0.2NHCl (c) 100 mL of 0.1NHCl (d) 200 mL of 0.2NHCl
3. The maximum kinetic energy of the photoelectrons is found to be 6.63×10^{-19} J when the metal is irradiated with a radiation of frequency 3×10^{15} Hz. The threshold frequency of the metal is -
 (a) 1×10^{15} Hz (b) 3×10^{15} Hz
 (c) 2×10^{16} Hz (d) 2×10^{15} Hz
4. A particle X moving with a certain velocity has a debroglie wave length of 1 \AA , If particle Y has a mass of 25% that of X and velocity 75% that of X, debroglies wave length of Y will be :
 (a) 3 \AA (b) 5.33 \AA (c) 6.88 \AA (d) 48 \AA
5. The dipole moment of  is 1.5 D. The dipole moment of  is:
 (a) 1 D (b) 1.5 D (c) 2.25 D (d) 3 D
6. An ionic bond $\text{A}^+ \text{B}^-$ is most likely to be formed when :
 (a) The ionization energy of A is high and the electron affinity of B is low
 (b) The ionization energy of A is low and the electron affinity of B is high
 (c) The ionization energy of A and the electron affinity of B is high
 (d) The ionization energy of A and the electron affinity of B is low
7. Equimolal solution in the same solvent have
 (a) Same elevation in boiling point and same depression in freezing point
 (b) Different elevation in boiling point and different depression in freezing point
 (c) Same elevation in boiling point but different depression freezing point
 (d) Same depression in freezing point but different elevation in boiling point.

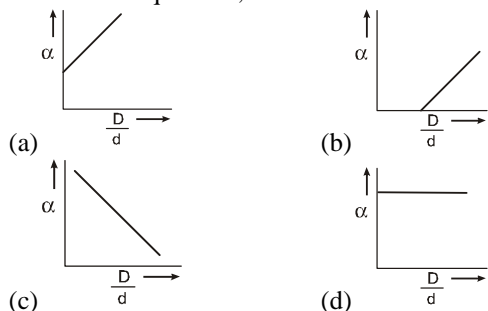
Space for rough work

8. According to Henry's law the partial pressure of the gas in vapor phase (p) is proportional to the mole fraction of the gas (x) in the solution for different gases the correct statement about Henry's constant is
- (a) Higher the value of K_H at a given pressure, higher is the solubility of the gas
(b) Higher the value of K_H at a given pressure, lower is the solubility of the gas
(c) K_H is not a function of nature of gas
(d) K_H value for all gases is same at a given pressure.
9. Which of the following conditions favours the existence of a substance in the solid state?
- (a) High temperature (b) Low temperature
(c) High thermal energy (d) Weak cohesive forces
10. A metal crystallizes in a bcc lattice. Its unit cell edge length is about 300 pm and its molar mass is about 50g mol^{-1} . What would be density of the metal?
- (a) 6.2g cm^{-3} (b) 3.1g cm^{-3}
(c) 9.3g cm^{-3} (d) 12.4g cm^{-3}
11. A flask containing air (open to atmosphere) is heated from 300 K to 500 K. the percentage of air escaped to the atmosphere is nearly
- (a) 16.6 (b) 40 (c) 66 (d) 20
12. At 300 K and under pressure of 100 atm the Z for O_2 is 0.96. At 600 K and under pressure of 150 atm the Z for O_2 is 0.8 for the same mass of O_2 . If the volume of O_2 at 300 K and 100 atm press is 2L, then what mass of O_2 (g) is required to fill a vessel of capacity 200 L at 600 K & 150 atm ?
- (a) 36 kg (b) 24.39 kg (c) 16.82 kg (d) 9.98 kg
13. The ratio of the amount of two elements X and Y at radioactive equilibrium is $1:2 \times 10^{-6}$. If the half-life period of element Y is 4.9×10^{-4} days, then the half-life period of element X will be
- (a) 4.8×10^{-3} days (b) 245 days
(c) 122.5 days (d) None of these
14. The sum of the number of neutrons and proton in the radio isotope of hydrogen is
- (a) 6 (b) 5
(c) 4 (d) 3

Space for rough work

15. It is found that the equilibrium constant increases by a factor of four when the temperature is increased from 25°C to 40°C . The value of ΔH° is
- (a) 25.46 kJ mol^{-1} (b) $171.67\text{ kJ mol}^{-1}$
 (c) 89.43 kJ mol^{-1} (d) 71.67 kJ mol^{-1}

16. In the above question, α varies with according to :



17. What is the minimum pH required to prevent the precipitation of ZnS in a solution that is 0.01 M ZnC and saturated with $0.10\text{ M H}_2\text{S}$?

[Given $K_{\text{sp}} = 10^{-21}$, $K_{\text{a}_1} \times K_{\text{a}_2} = 10^{-20}$]

- (a) 0 (b) 1 (c) 2 (d) 4
18. When 100 ml of $\text{N}/10\text{ NaOH}$ are added to 50 ml of $\text{N}/5\text{ HCl}$, the pH of the resulting solution is -
- (a) 7 (b) greater than 7 (c) less than 7 (d) Zero

19. $\frac{1}{2}\text{ N}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow \text{NO}_2(\text{g})$ $\Delta_r H^{\circ} = -40\text{ kJ/mol}$

Given : $C_{\text{p,m}}(\text{NO}_2, \text{g}) = 40\text{ J/mol/K}$;

$C_{\text{p,m}}(\text{O}_2, \text{g}) = 30\text{ JK}^{-1}\text{ mol}^{-1}$

$C_{\text{p,m}}\text{ N}_2(\text{g}) = 30\text{ JK}^{-1}\text{ mol}^{-1}$

What is the enthalpy of formation of $\text{NO}_2(\text{g})$ at 1298 K ?

- (a) -40 kJ/mol (b) -50 kJ/mol
 (c) -45 kJ/mol (d) -6 kJ/mol
20. The standard heat of combustion of solid boron is equal to :
- (a) $\Delta H^{\circ}_{\text{f}}(\text{B}_2\text{O}_3)$ (b) $1/2 \Delta H^{\circ}_{\text{f}}(\text{B}_2\text{O}_3)$
 (c) $2 \Delta H^{\circ}_{\text{f}}(\text{B}_2\text{O}_3)$ (d) $1/2 \Delta H^{\circ}_{\text{f}}(\text{B}_2\text{O}_3)$

Space for rough work

21. The rate of reaction between two reactants A and B decreases by a factor 4 if the concentration of reactant B is doubled. The order of this reaction with respect to B is -
(a) -1 (b) -2 (c) 2 (d) 1
22. The rate law for a reaction between the substances A and B is given by rate = $k[A]^n[B]^m$. On doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of the reaction will be as
(a) $\frac{1}{2^{m+n}}$ (b) $(m+n)$ (c) $(n-m)$ (d) $2(n-m)$
23. Four moles of electrons were transferred from anode to cathode in an experiment on electrolysis of water. The total volume of the two gases (dry and S.T.P.) produced will be approximately (in litres)
(a) 22.4 (b) 44.8 (c) 67.2 (d) 89.4
24. Electrolysis is carried out in three cells :
In cell (a) : 1(M) CuSO_4 solution is electrolysed using Pt electrodes.
In cell (b) : 1(M) CuSO_4 solution is electrolysed using Cu electrodes.
In cell (c) : 1(M) KCl solution is electrolysed using Pt electrodes.
Which of the following is/are correct ?
(a) In cell (a) : the pH of the solution is decreased
(b) In cell (b) : the pH of the solution remain/constant
(c) In cell (c) : the pH of the solution is increased
(d) All of the given are correct
25. Which is not an oxidizing agent ?
(a) KClO_3 (b) O_2 (c) CH_4 (d) $\text{K}_2\text{Cr}_2\text{O}_7$
26. Volume of N_2 at NTP required to form a mono layer on the surface of iron catalyst is 8.15 ml/gram of the adsorbent. What will be the surface area of the adsorbent per gm if each nitrogen molecule occupies $16 \times 10^{-22} \text{m}^2$.
(a) $16 \times 10^{-16} \text{cm}^2$ (b) $0.35 \text{m}^2/\text{g}$
(c) $0.35 \text{m}^2/\text{g}$ (d) 22400cm^2
27. Gold number Ofhaemoglobin is 0.03. Hence, 100 mL of gold sol will require haemoglobin so that gold is not coagulated by 1 mL of 10% NaCl solution :
(a) 0.03 mg (b) 30 mg (c) 0.30 mg (d) 3 mg
28. In which of the following compounds Mn exhibit maximum radius ?
(a) MnO_2 (b) KMnO_4 (c) MnO (d) $\text{K}_3[\text{Mn}(\text{CN})_6]$

Space for rough work

Section - B

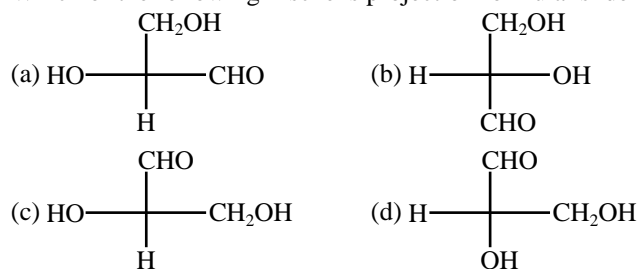
35. In curing cement plasters, water is sprinkled from-time to time. This helps in:
- Developing interlocking needle like crystals of hydrate silicates
 - Hydrated sand gravel mixed with cement
 - Converting sand into silicic acid
 - Keeping it cool
36. Which of the following factor may be regarded as the main cause of Lanthanide contraction?
- Poor shielding of 4 f-electrons in compare to other electrons in the sub-shell.
 - Effective shielding of one of the 4 f-electrons by another in the sub-shell.
 - Poorer shielding of 5 d electron by 4 f- electrons.
 - Greater shielding of 5 d electron by 4 f- electron.
37. The number of moles of KMnO_4 that will be needed to react completely with one mole of ferrous oxalate in acidic solution is :
- (a) 3/5 (b) 2/5 (c) 4/5 (d) 1
38. Select the correct statement.
- Complex ion $[\text{MoCl}_6]^{3-}$ is paramagnetic.
 - Complex ion $[\text{Co}(\text{en})_3]^{3+}$ is diamagnetic.
 - Both (a) and (b) are correct.
 - None of correct.
39. Which of the following statements is not true about the complex ion $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$?
- It has two geometrical isomers – cis and trans.
 - Both the cis and trans isomers display optical activity.
 - Only the cis isomer displays optical activity.
 - Only the cis isomer has non-super imposable mirror image.
40. Chromyl chloride vapors are dissolved in NaOH and acetic acid and lead acetate solution is added, then
- The solution will remain colorless
 - The solution will become dark green
 - A yellow solution will be obtained
 - A yellow precipitate will be obtained

Space for rough work

41. A salt gives bright red colour to the flame. This colour indicates the presence of

- (a) Ba^{2+} (b) Sr^{2+}
 (c) Ca^{2+} (d) Cr^{3+}

42. Which of the following Fischer's projection formula is identical to D-glyceraldehyde?



43. The oxidation number of Phosphorus in $Mg_2P_2O_7$ is :

- (a) +3 (b) +2 (c) +5 (d) -3

44. The hourly energy requirement of an astronaut can be satisfied by the energy released when 34 g of sucrose ($C_{12}H_{22}O_{11}$) are burnt in his body. How many g of oxygen would be needed to be carried in space capsule to meet his requirement for one day:

- (a) 916.2 gm (b) 91.62 gm (c) 8.162 gm (d) 9.162 gm.

45. The product(s) via-oxymmercuration ($HgSO_4 + H_2SO_4$) of 1-butyne would be:

- (a) $CH_3 - CH_2 - \overset{\overset{O}{||}}{C} - CH_3$
 (b) $CH_3 - CH_2 - CH_2 - CHO$
 (c) $CH_3 - CH_2 - CHO + HCHO$
 (d) $CH_3 - CH_2 - COOH + HCOOH$

46. Bottles containing C_6H_5I and $C_6H_5CH_2I$ lost their original labels. They were labelled A and B for testing. A and B were separately taken in a test tube and boiled with NaOH solution. The end solution in each tube was made acidic with dilute HNO_3 and then some $AgNO_3$ solution was added. Substance B gave a yellow precipitate. Which one of the following statements is true for this experiment?

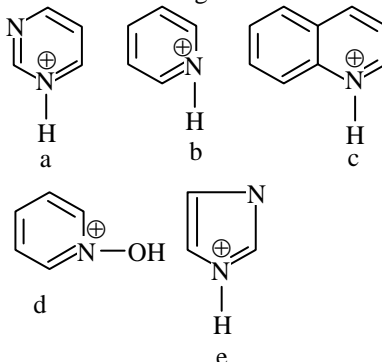
- (a) A was C_6H_5I
 (b) A was $C_6H_5CH_2I$
 (c) B was C_6H_5I
 (d) Addition of HNO_3 was unnecessary

Space for rough work

47. A compound with molecular mass 180 is acylated with CH_3COCl to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is :
 (a) 2 (b) 5 (c) 4 (d) 6

48. How will you convert butan-2-one to propanoic acid
 (a) Tollen's reagent (b) Fehling's solution
 (c) $\text{NaOH} / \text{I}_2 / \text{H}^+$ (d) $\text{NaOH} / \text{NaI} / \text{H}^+$

49. Which of the following statement is correct about the basic strength on the basis of given data?



The correct pK_a order is -

- (a) $a > b < c$ (b) $b > c > e$
 (c) $a > e > b > c$ (d) $d > a > e < c$
50. An amino acid for which isoelectric point lies in acidic medium when kept in alkaline medium in electric field will show migration towards -
 (a) Cathode (b) Anode
 (c) Either Cathode/Anode (d) No migration

Space for rough work

BIOLOGY

Section- A

- Main function of pedicellariae in Asterias is
 (a) Digestion
 (b) Excretion
 (c) Respiration
 (d) Capture of prey and removal of debris
- Cold blooded animals are those having
 (a) Cold blood
 (b) Variable body temperature according to the temperature of atmosphere
 (c) Always constant temperature
 (d) Blood, which can flow even below 4°C

3. Which of the following group of animals maintain high and constant body temperature such as mammals
(a) Reptiles (b) Amphibians
(c) Birds (d) Fishes
4. An IUCD is:-
(a) Vasectomy
(b) Copper T
(c) Condom
(d) All above
5. What is the work of copper T-
(a) To inhibit ovulation
(b) To prevent fertilization
(c) To inhibit implantation of blastocyst
(d) To inhibit gametogenesis
6. IVF technique includes?
(a) GIFT
(b) A.I.
(c) IUT
(d) All the above
7. A gland not associated with alimentary canal is
(a) Pancreas (b) Liver
(c) Salivary glands (d) Adrenal
8. Secretin:
(a) Stimulates enzymes secretion by pancreas, inhibits acid secretion in stomach, stimulates gall bladder
(b) Stimulates bicarbonate secretion by pancreas, inhibits acid secretion in stomach, stimulates bicarbonate secretion by liver
(c) Stimulates acid secretion in stomach, potentiates action of CCK, inhibits intestinal movement
(d) Stimulates gall bladder, inhibits acid secretion in stomach, stimulates bicarbonate secretion by pancreas
9. Chymotrypsinogen is produced by
(a) Liver
(b) Pancreas
(c) Stomach
(d) Duodenum
10. What is true about diffusion capacity.
(a) Diffusion capacity of CO₂ is much higher than O₂
(b) Diffusion capacity of O₂ is much higher than CO₂
(c) Diffusion capacity of O₂ and CO₂ is same
(d) None of the above

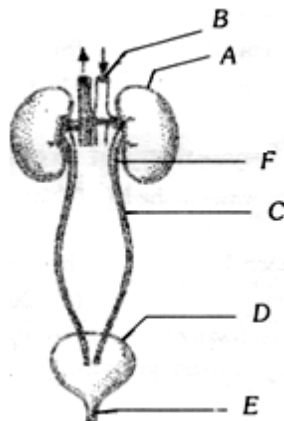
11. Which of the following group of animals, is used Lungs for respiration?

- (a) Fishes, Frog, Tadpole larva
- (b) Fish, Mollusca, aquatic arthropods
- (c) Reptiles, Birds, Mammals
- (d) Insects, Earthworm, Mollusca

12. Find out the correct match from the following: -

- (i) Larynx - sound box
 - (ii) Trachea - complete cartilagenous rigins
 - (iii) Epiglottis - elastic cartilagenous flap
 - (iv) Alveoli - very thin, irregular wall ed, vascularised bag like structures
 - (v) Pleural fluid - reduces friction on the lung surface
- (a) (i), (ii), (iii), (iv), (v)
 - (b) (i), (iii), (iv), (v)
 - (c) (i), (iii), (v)
 - (d) (i) and (v)

13. In the diagram of excretory system of human beings given below, different parts have been indicated by alphabets choose the answers in which these alphabets have been correctly matched with the plants which they represent



- (a) A = Kidney, B = Abdominal aorta, C = Urethra, D = Urinary bladder, E = Ureters, F = Renal pelvis
- (b) A = Kidney, B = Renal pelvis, C = Urethra, D = Urinary bladder, E = Ureters, F = Abdominal aorta
- (c) A = Kidney, B = Abdominal aorta, C = Ureters, D = Urinary bladder, E = Urethra, F = Renal pelvis
- (d) A = Kidney, B = Abdominal aorta, C = Urethra, D = Urinary bladder, E = Renal pelvis, F = Ureters

14. Among ammonia, uric acid and urea; which one needs the least amount of water to excrete?

- (a) Ammonia (b) Uric acid
- (c) Urea (d) Both (b) and (c)

15. The functioning of the kidneys is efficiently monitored and regulated by the hormonal feedback mechanism involving

- (a) hypothalamus (b) JGA
- (c) heart (d) All of these

- 16.** Which pair of systems jointly coordinate and integrate all the activities of organs, so that they function in a synchronised fashion?
- (a) Neural and respiratory
 - (b) Neural and digestive system
 - (c) Neural and endocrine system
 - (d) Neural and circulatory system
- 17.** Cerebellum is concerned with the
- (a) contraction of voluntary muscles
 - (b) coordinating and regulation muscles tone
 - (c) maintaining posture, orientation and equilibrium of body
 - (d) All of the above
- 18.** Middle ear of humans contains ossicles, i.e.
- (a) malleus (b) incus
 - (c) stapes (d) All of these
- 19.** The inner layer of gizzard of cockroach is covered by :
- (a) By cuticle
 - (b) By mucous membrane
 - (c) By endoepithelium
 - (d) By peritrophic membrane
- 20.** Ommatidia are units in the eyes of :
- (a) Amphibians
 - (b) Mammals
 - (c) Insects
 - (d) Fishes
- 21.** In which of the following moulting is not found?
- (a) Hydra
 - (b) Mosquito
 - (c) Housefly
 - (d) Cockroach
- 22.** Which of the following sets do not have homologous organs?
- (a) Wings of mosquito and butterfly
 - (b) Wings of butterfly and bat
 - (c) Mouth parts of cockroach and butter fly
 - (d) None of them
- 23.** Greatest advantage of bipedal movement:
- (a) Fore arms becoming free for carrying out order of brain
 - (b) Greater speed
 - (c) Support the body properly
 - (d) Loss of weight
- 24.** The wings of a bird and the wings of an insect are:
- (a) homologous structures and represent convergent evolution
 - (b) homologous structures and represent divergent evolution
 - (c) analogous structures and represent convergent evolution
 - (d) phylogenetic structures and represent divergent evolution

25. Industrial melanism is an example of:

- (a) Neo Lamarckism
- (b) Neo Darwinism
- (c) Natural selection
- (d) Mutation

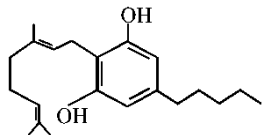
26. Carcinoma is a cancer of:

- (a) Lymphocytes
- (b) Connective tissue
- (c) Erythrocytes
- (d) Ectoderm and endoderm

27. Marijuana, Ganja, and LSD are: -

- (a) Narcotics
- (b) Hallucinogens
- (c) Stimulants
- (d) Medicines

28. The given diagram is showing skeletal structure of cannabinoid molecule. Cannabinoids interact with cannabinoid receptors present principally in the brain. Natural cannabinoids are obtained from inflorescences of the plant *cannabis sativa*. Nature of cannabinoids is : -



- (a) Aliphatic
- (b) Phenolic
- (c) Ketonic
- (d) Ether

29. Most radiosensitive tissue of body is :

- (a) bone marrow
- (b) platelet
- (c) nervous tissue
- (d) lymphocyte

30. A plant, native of south america is a source of a drug of addiction which is CNS stimulant. This drug inhibits transport of

- (a) Acetylcholine
- (b) Dopamine
- (c) Serotonin
- (d) Adrenaline

31. Select the incorrect statement

- (a) LH and FSH decrease gradually during the follicular phase
- (b) FSH stimulates the sertoli cells which help in spermiogenesis
- (c) LH triggers ovulations in ovary
- (d) LH triggers secretions of androgens from the leydig cells

32. Along with which hormone parathyroid hormone plays a significant role in Ca-balance in the body?
(a) T3 (b) T4 (c) TCT (d) IAA
33. Which of the following is not the hormone of anterior pituitary?
(a) Prolactin (b) Oxytocin
(c) ACTH (d) Growth hormone
34. The 24 hour (diurnal) rhythm of our body such as the sleep-wake cycle is regulated by the hormone:
(a) Calcitonin (b) Prolactin (c) Adrenaline (d) Melatonin
35. To isolate DNA from fungi we have to break the wall. This is done by
(a) Lysozyme
(b) Cellulose
(c) Invertase
(d) Chitinase

Section - B

36. Cry - gene which synthesizes crystal protein isolated from : -
(a) Bacillus thuringiensis
(b) Rhizobium
(c) Bacillus polymyxa
(d) Clostridium
37. Which of the following peptide chain is not present in mature insulin.
(a) A - peptide
(b) B - peptide
(c) C - peptide
(d) A & B peptide
38. An example of gene therapy is
(a) Production of injectable Hepatitis - B vaccine
(b) Production of vaccines in food crops like potatoes which can be eaten
(c) Introduction of gene for adenosine deaminase in persons suffering from severe combined immunodeficiency (SCID)
(d) Production of test tube babies by artificial insemination and implantation of fertilized eggs
39. Which cell division is found during cleavage?
(a) Amitosis
(b) Mitosis
(c) Closed mitosis
(d) Meiosis
40. Which layer develops first during embryonic development :
(a) Ectoderm
(b) Mesoderm

- (c) Endoderm
- (d) Both '1' and '3'

41. Purpose of tubectomy is to prevent:

- (a) Fertilization
- (b) Coitus
- (c) Egg formation
- (d) Embryonic development

42. Vertebrochondral rib in man are: -

- (a) 8th, 9th & 10th rib
- (b) 7th, 8th, 9th rib
- (c) 9th, 10th & 11th rib
- (d) 6th, 7th & 8th rib

43. The iron free compound of haemoglobin is

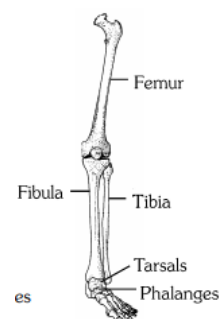
- (a) Globin (b) Haematin (c) Bilirubin (d) Haemotoxin

44. Which of the following is a sesamoid bone?

- (a) Pelvic
- (b) Patella
- (c) Pterigoid
- (d) Pectoral girdle

45. Given below is a diagram of the bones of the left human hindlimb as seen from front. It has certain mistakes in labeling. Two of the wrongly labelled bones are: -

- (a) Tibia and tarsals
- (b) Femur and fibula
- (c) Fibula and phalanges
- (d) Tarsals and femur



46. Systolic pressure is higher than diastolic pressure because

- (a) Arteries are contracting during systole
- (b) Blood is pumped with a pressure in the arteries by the heart during systole but not during diastole.
- (c) Arteries resist during systole only.
- (d) Volume of blood is higher in systole than that of diastole in the heart

47. In humans, RBCs are formed in

- (a) red bone marrow (b) heart
- (c) lungs (d) yellow bone marrow

(d) Sporophytes of ferns live much longer as compared to the sporophytes of mosses.

7. The inflorescence in Gramineae is :-

- (a) Raceme (b) Catkin (c) Spike of spikelets (d) Thyrsus

8. In scapigerous umbel, flowers are arranged in which manner :-

- (a) Corymb (b) Catkin (c) Panicle (d) Monochasial cyme

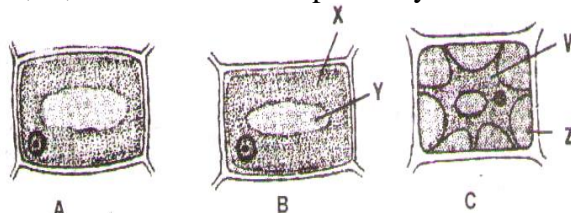
9. In (i) Protoxylem lies towards periphery and metaxylem lies towards centre. Such an arrangement of primary xylem is called as (ii)

- | | |
|-----------|---------|
| (i) | (ii) |
| (a) Stems | Endarch |
| (b) Stems | Exarch |
| (c) Roots | Exarch |
| (d) Roots | Endarch |

10. Secondary growth is the production of

- (a) New tissues from intercalary meristem (b) New conduction cells
(c) New tissues from lateral meristem (d) New ground cells

11. The accompany diagram show plasmolysis in cell. A is normal turgid cell, B shows incipient plasmolysis and C is plasmolysed cell. Identify W, X, Y and Z and Z respectively.



- (a) Shrunken protoplast, Protoplast, Vacuole, External solution
(b) Turgid protoplast, Protoplast, Vacuole, External solution
(c) Shrunken protoplast, Flaccid protoplast, Vacuole, External solution
(d) Shrunken protoplast, Protoplast, Vacuole, Hypotonic solution

12. Opening of stomata is due to: -

- (a) Turgidity of guard cells (b) Size of guard cells
(c) Number of guard cells (d) Amount of CO₂ in the atmosphere

13. The biochemical objective of PSI is to –

- (a) Oxidise NADPH (b) Hydrolyze ATP
(c) Phosphorylate ADP (d) Reduce NADP⁺

14. Which one (s) is correct for C₃ plants?

- (a) Photosynthetic CO₂ fixation and photo respiratory oxygenation are competing reactions.
(b) Competition between carboxylation and oxygenation decreases the efficiency of photosynthesis
(c) Carboxylation and oxygenation are closely interlocked in the intact leaf
(d) All

15. Parenchymatous cell that are made to divide under controlled laboratory conditions dunnng plant tissue culture are : -

- (a) differentiated cells (b) dedifferentiated cells
 (c) undifferentiated cells (d) redifferentiated cells

16. Arithmetic growth is related to : -

- (a) $L_t = L_0 e^{rt}$ (b) $W_1 = W_0 e^{rt}$ (c) $L_t = L_0 + rt$ (d) $L_0 = L_t + rt$

17. (i) Promote nutrient mobilisation
 (ii) Overcome the apical dominance
 (iii) Lateral shoot growth

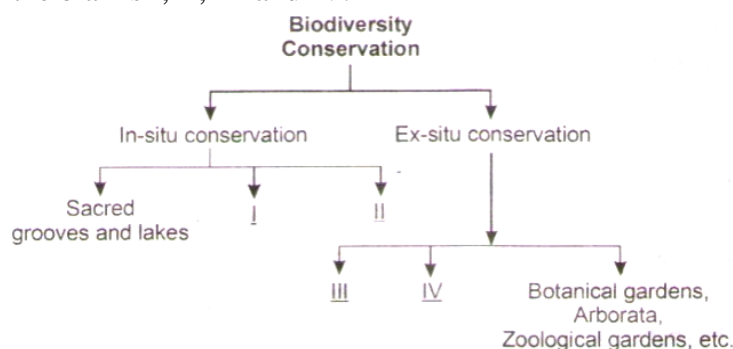
All the above physiological effects are related to which of the following plant growth regulators?

- (a) Auxins (b) Gibberellins (c) Abscisic acid (d) Cytokins

18. The term “the evil quartet” is related with four major causes of

- (a) Forest loss (b) Biodiversity losses
 (c) Population explosion (d) Air pollution

19. Given below is incomplete flow chart depicting in-situ and ex-situ approaches of conserving biodiversity. Study carefully and fill in the blanks I, II, III and IV.



- (a) I – Biosphere reserves; II – National parks and wildlife sanctuaries; III – Sacred plants, Home gardens; IV – Seed banks, field gene banks, cryopreservation, etc
 (b) I – Sacred plants, Home gardens; II – National parks and wildlife sanctuaries; III – Biosphere reserves; IV – Seed banks, field gene banks, cryopreservation, etc
 (c) I – Biosphere reserves; II – Seed banks, field gene banks, cryopreservation, etc; III – Sacred plants, Home gardens; IV – National parks and wildlife sanctuaries
 (d) I – Biosphere reserves; II – Sacred plants, Home gardens; III – National parks and wildlife sanctuaries; IV – Seed banks, field gene banks, cryopreservation, etc.

20. Column I

- I. Nile Perch in Lake Victoria
 II. Narrowly utilitarian
 III. Main cause for biodiversity loss
 IV. Hot spots

Column II

- (a) Obvious reasons for biodiversity conservation
 (b) Habitat destruction
 (c) High endemism
 (d) Alien species
 (b) I – D, II – A, III – B, IV – C
 (d) I – B, II – A, III – C, IV – D

- (a) I – B, II – A, III – D, IV – C
 (c) I – A, II – C, III – B, IV – D

21. Exchange of germplasm is carried preferably through shoot tip culture because they are

- (a) Genetically stable (b) Small and handy (c) Virus free (d) Cost is very low

22. 'Cloning' is meant for

- (a) Production of *HGH* gene in *E. coli* (b) To preserve the genotype of organism

- (c) To replace the original gene (d) All of these
23. Genetically engineered human insulin is called
(a) Humulin (b) Haematin (c) Hybridoma (d) Hybrid
24. Number of oxygen atoms required for aerobic oxidation of one pyruvate –
(a) 5 (b) 8 (c) 10 (d) 12
25. When 2-pyruvic acids form two lactic acid by anaerobic respiration then?
(a) One ATP is lost (b) 3 ATP is lost (c) 6 ATP is lost (d) None
26. Which of the following is a common feature between glycolysis and Krebs cycles? -
(a) Release of CO₂ . (b) Formation of FADH₂ . (c) Site of the processes. (d) Dehydrogenation.
27. In mitochondrial ETS, cytochrome 'C' acts as a mobile carrier for transfer of electrons between: -
(a) Complex III and IV (b) Complex I and II (c) Complex II and III (d) Complex IV and V
28. Carbohydrates which are present in the cell membrane take part in: -
(a) Transport of substance (b) Cell recognition
(c) Attachment to microfilament (d) Attachment to microtubules
29. Cell theory was proposed by -
(a) A Botanist (b) A Zoologist (c) A botanist and zoologist (d) A psychologist
30. Which of the following are correct for the cell which has naked ds circular DNA?
(A) Both 70S and 80S ribosomes
(B) Histone absent
(C) Compartmentalisation of cytoplasm absent
(D) Always diploid
(a) A and D
(b) B and C
(c) A and C
(d) B and D
31. Chromosome number is reduced during meiosis because the process consists of -
(a) Two cell divisions without any chromosome replication
(b) A single cell division without any chromosome replication
(c) Two cell divisions in which half of the chromosomes are destroyed
(d) Two cell divisions and only single round of chromosome replication
32. The milestone that defines anaphase is when the chromosomes / chromatids
(a) Separate (b) Come together (c) Are at opposite poles (d) Line up
33. The sequence of events by which a cell duplicates its genome, synthesises the other constituents of the cell and eventually divides into two daughter cells is termed as
(a) cell division (b) cell cycle (c) cell growth (d) cell duplication
34. Which one is not an essential element in plants
(a) Iron (b) Boron (c) Sulphur (d) Cadmium

35. The theory which suggest that the CO_2 produced in respiration plays an important role in mineral absorption
- (a) Contact exchange theory (b) Carbonic acid exchange theory
(c) Active absorption theory (d) None the above

Section - B

36. Estrus cycle is found in
- (a) Gibbon (b) Gorilla (c) Cow (d) Monkey

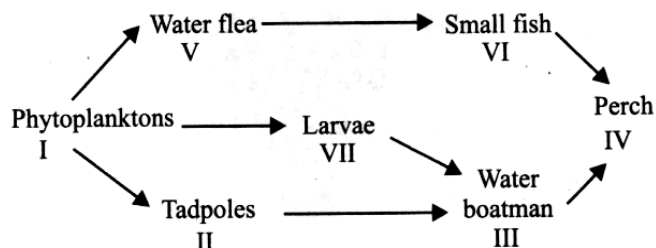
37. Read the following four statements (A - D):

- (A) In asexual reproduction, offspring produced with or without involvement of gametes
(B) In asexual reproduction, clones are formed
(C) Asexual reproduction is very common in single celled organisms
(D) Budding in Hydra is a mode of sexual reproduction

How many of the above statements are correct

- (a) Four (b) Three (c) Two (d) One

38. **Direction :** Study the food web given below and answer the questions that follow.



Which of the following organisms in the given food web acts as a secondary consumer?

- (a) II and V (b) VII only (c) IV only (d) III and VI

39. In an ecosystem, the population of

- (a) Primary producer is greater than primary consumers
(b) Secondary consumers are largest
(c) Primary consumers out number primary
(d) Primary consumer is least dependent upon primary producers.

40. The overall productivity in terrestrial ecosystems is limited by

- (a) Temperature (b) Water
(c) Sunlight (d) A combination of the above

41. The phenotypic and genotypic ratios remain same in F_2 generation in case of

- (a) Dihybrid cross (b) Supplementary genes
(c) Incomplete dominance (d) Inhibitory genes

42. Which of the following statements is true?

- (a) Mendel's laws are less accurate than Punnett square results.
(b) Mendel's laws are useful only in unusual situations.
(c) Mendel's laws always correctly determine how genes are inherited.
(d) Mendel's laws always correctly predict the phenotype of an organism.

43. DNA was first discovered by-

- (a) Meischer (b) Robert Brown (c) Flemming (d) Watson & Crick

44. The enzyme responsible for transcription is: -

- (a) D.N.A polymerase-I (b) R.N.A. polymerase
(c) Reverse transcriptase (d) D.NA. polymerase-III

45. Mutation is: -

- (a) An abrupt or discontinuous change which is inherited
(b) A factor for plant growth
(c) A change which affects parents only and is never inherited
(d) A change which affects the offspring of F₂ generation

46. Are present in.

- (a) Soil (b) Thermal vents (c) Polluted water (d) All of these

47. Microbial insecticide is:

- (a) *Bacillus polymixa* (b) *Bacillus brevis* (c) *Bacillus subtilis* (d) *Bacillus thuringiensis*

48. Match the following column correctly: -

| | Column I | | Column II |
|---|--------------|-----|------------------------------|
| A | Statins | i | <i>Monascus purpureus</i> |
| B | Cyclosporins | ii | <i>Trichoderma</i> |
| C | Acetic acid | iii | <i>Acetobacter aceti</i> |
| D | Butyric acid | iv | <i>Clostridium butyricum</i> |

Options: -

- (a) A - i, B - ii, C - iii, D - iv (b) A - ii, B - i, C - iv, D - iii
(c) A - ii, B - i, C - iii, D - iv (d) A - iii, B - iv, C - i, D - ii

49. The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show?

- (a) The population of its predators increases enormously
(b) S-shaped or sigmoid growth of this insect
(c) The food plants mature and die at the end of the rainy season.
(d) Its population growth curve is of J-type

50. The logistic population growth is expressed by the equation:

- (a) $\frac{dN}{dt} = rN \left(\frac{N - K}{N} \right)$ (b) $\frac{dN}{dt} = Nr \left(\frac{K - N}{K} \right)$
(c) $\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$ (d) $\frac{dN}{dt} = rN$