Max. Time : $3\frac{1}{2}$ Max. Marks : 200

# PART A. PHYSICS

**1. Car A is moving with a speed of $36 \text{ km h}^{-1}$ on a two - lane roads. Two cars B and C, each moving with a speed of $54 \text{ km h}^{-1}$ in opposite directions on the other lane are approaching car A. At a certain instant when the distance AB = distance AC = 1 km, the driver of car B decides to overtake A before C does. What must be the minimum acceleration of car B so as to avoid in accident ?**

(1) $4 \text{ ms}^{-2}$ (2) $3 \text{ ms}^{-2}$

(3) $2 \text{ ms}^{-2}$ (4) $1 \text{ ms}^{-2}$

**2. The momentum of a body increases by 20%. What is the percentage increase in its kinetic energy ?**

(1) 60 (2) 52 (3) 44 (4) 36

**3. Two blocks of equal mass $m_1 = m_2 = 3$ kg, connected by a light string, are placed on a horizontal surface which is not frictionless. If a force of 20 N is applied in the horizontal direction on a block, the acceleration of each block is $0.5 \text{ ms}^{-2}$. Assuming that the frictional forces on the two blocks are equal, the tension in the string will be**

(1) 60 N (2) 40 N

(3) 20 N (4) 10 N

**4. A man P of mass 80 kg runs up a staircase in 12 seconds. Another man Q of mass 60 kg runs up the same staircase in 11 seconds. What is the ratio of the power developed by P to that by Q ?**

(1) 11/9 (2) 49/33 (3) 12/11 (4) 4/3

**5. A molecule consists of two atoms, each of mass m, separated by a distance a. The moment of inertia of the molecule about its centre of mass is**

(1) $\frac{1}{4} ma^2$ (2) $\frac{1}{2} ma^2$

(3) $2 ma^2$ (4) $ma^2$

**6. An earth satellite is kept moving in orbit by the centripetal force provided by**

(1) the gravitational attraction f the earth

(2) the gravitational attraction of the sun

(3) the ejection of hot gases from its exhaust

(4) the burning of fuel in its engine

**7. A boat carrying a number of large stones is floating in a water tank. What will happen to the water level if the stones are unloaded into the water ? The water levels**

(1) rises (2) falls (3) remains unchanged

(4) rise till half the number of stones are unloaded and then begins to fall.

**8. A capillary tube or radius r is immersed in water and water rises in it to a height. The mass of water in the capillary tube is 5g. Another capillary tube of radius 2r is immersed in water . The mass of water that will rise in this tube is**

(1) 10 g (2) 20 g (3) 5.0 g (D) 2.5 g

**9. Two wires A and B of the same material have their lengths in the ratio of 1 : 2 and their diameters in the ratio of 2 : 1. If they are stretched with the same force, the ratio of the increase in the length of A to that of B will be**

(1) 1 : 4 (2) 1 : 8

(3) 4 : 1 (4) 1 : 2

**10. If there are no heat losses, the heat released by the condensation of x grams**

of steam at 100°C. The ratio y/x is nearly

(1) 4 (2) 3 (3) 2 (4) 1

**11. Which one of the following is the correct relationship between pressure P and volume V of an ideal gas undergoing an adiabatic expansion ($\gamma$ is the ratio of the two specific heats) ?**

(1) $PV^{l/\gamma}$ = constant (2) $PV^{\gamma/\gamma-1}$ = constant

(3) $PV^{\gamma}$ = constant (4) $PV^{\gamma-1}$ = constant

**12. A spring of of\force constant k is cut into three equal pieces. If these three pieces are connected in parallel, the force constant of the combination will be**

(1) 3k (2) 9k (3) k (4) k/3

**13. If the Young's modulus of the material of a rod is $2 \times 10^{11}\ N\ m^{-2}$ and is density is $8000\ kg\ m^{-3}$, the time taken by a sound wave to traverse 1 m of the rod will be**

(1) $2 \times 10^{-2}$ s (2) $10^{-2}$ s

(3) $10^{-4}$ s (4) $2 \times 10^{-4}$ s

**14. The electric potentials V ( in volt ) varies with x ( in metre ) according to the relation $V + 5 + 4x^2$. The force experienced by a negative charge of $2 \times 10^{-6}$ C located at x = 0.5 m is**

(1) $8 \times 10^{-6}$ N (2) $2 \times 10^{-6}$ N

(3) $4 \times 10^{-6}$ N (4) $6 \times 10^{-6}$ N

**15. A uniform copper wire of length 1 m and cross -sectional area $5 \times 10^{-7}\ m^2$ carries a current of 1 A. Assuming that there are $8 \times 10^{28}$ free electrons per $m^3$ in copper, how long will en electron takes to drift from one end of the wire to the other ?**

(1) $6.4 \times 10^3$ s (2) $3.2 \times 10^3$ s

$1.6 \times 10^3$ s (4) $0.8 \times 10^3$ s

**16. The maximum power rating of a 20 Ω resistor is 1 kW. If the integral resistance of the dc source is negligible , then this resistor can be safely used across a**

(1) 150 V dc source (2) 200 V dc source

(3) 50 V dc source (4) None of these

**17. A string of length L = 1m is fixed at one end and carries a mass of 100g at the other end. the string makes $\sqrt{5}/\pi$ revolutions per second about vertical axis passing through its second end. The tension in the string is**

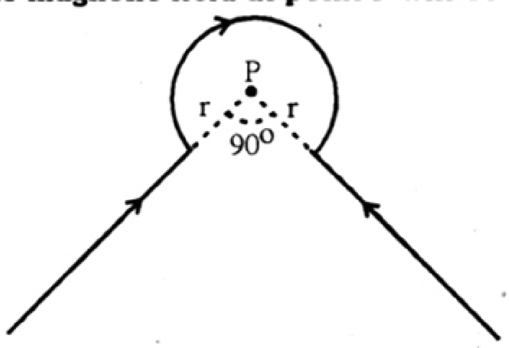
(1) N (2) 2N (3) 3N (4) 5N

**18. A proton (mass $= 1.7 \times 10^{-27}$ kg) moves with speed of $5 \times 10^5\ ms^{-1}$ in a direction perpendicular to a magnetic field of 0.17 T. The acceleration of the proton is**

(1) $8 \times 10^{12}\ ms^{-2}$ (2) $4 \times 10^{12}\ ms^{-2}$

(3) $2 \times 10^{12}\ ms^{-2}$ (4) zero

**19. The wire shown in figure (below) carries a current of 40 A. If r = 3.14 cm, the magnetic field at point P will be**




(1) $3.2 \times 10^{-3}$ T (2) $4.8 \times 10^{-3}$ T

(3) $6.4 \times 10^{-3}$ T (4) $1.6 \times 10^{-3}$ T

**20. In Young's double - slit experiment, the intensity of light at a point on the screen where the path difference is $\lambda$ is K units. What is the intensity of light at a point where the path difference is $\lambda/3$; $\lambda$ being the wavelength of light used ?**

(1) K (2) K/2 (3) K/3 (4) K/4

**21. What is the luminous intensity of a lamp which produces an illuminance of 12 lux at a distance of 5.0 m from it ?**

(1) 300 cd (2) 400 cd

(3) 100 cd (4) 200 cd

**22.** A monoenergetic electron beam with electron speed of $5.28 \times 10^6$ ms$^{-1}$ is subjected to a magnetic field of $2 \times 10^{-4}$ T normal to the back velocity. What is the radius of the circular path traced by the beam ? Given $e/m$ for electron $= 1.76 \times 10^{11}$ C kg$^{-1}$.

(1) 20 cm (2) 15 cm
(3) 10 cm (4) 5 cm

**23.** The energy of a photon corresponding to the visible light of maximum wavelength is approximately equal to

(1) 2.0 eV (2) 2.5 eV
(3) 1.0 eV (4) 1.5 eV

**24.** A light signal (photon) cannot escape from the surface of a

(1) neutron star (2) black hole
(3) red giant (4) white dwarf

**25.** On increasing the reverse bias to a large value in a pn junction diode, the current

(1) remains fixed (2) suddenly increased
(3) decreases slowly (4) Increased slowly

**26.** In Boolena algebra $\overline{1} + \overline{1}$ equals

(1) 2 (2) 1
(3) 0 (4) both 0 and 1

**27.** Which of the following crystals have a hexagonal structure ?

(1) zinc (2) calcite
(3) quartz . (4) both (1)&(3)

**28.** When a $\beta$-particle is emitted from a nucleus, the neutron-proton ratio

(1) is increased (2) is decreased
(3) remains the same
(4) first decreases then increases

**29.** If the end A of a wire is irradiated with alpha rays and the end B is irradiated with beta rays, then

(1) a current will flow from B to A
(2) a current will flow from A to B
(3) there will be no current in the wire
(4) a current will flow from each end to the mid point of the wire

**30.** If A, Z and N denote the mass number , the atomic number and the neutron number for a given nucleus, then which of the following statement is incorrect?

(1) isobar have the same A but different Z and N
(2)isotopes have the same Z but different N and A
(3) isotones have the same N but different A and Z
(4) N = Z+A

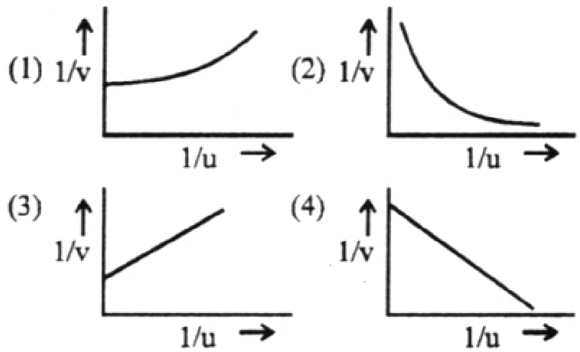
**31.** Moving with the same velocity, which of the following has the longest de Broglie wavelength ?

(1) neutron (2) proton
(3) $\beta$ - particle (3) $\alpha$ - particle

**32.** A concave lens of focal length 20 cm placed in contact with a plane mirror acts as a

(1) concave mirror of focal length 10 cm
(2) concave mirror of focal length 60 cm
(3) concave mirror of focal length 40 cm
(4) convex mirror of focal length 10 cm

**33.** If a graph is plotted between 1/v and 1/u, which one of the graphs shown in figure is approximately correct ?




**34.** A particle of mass m and q is released from rest in a uniform electric field E. The kinetic energy attained by the particle, after moving a distance x is

(1) $q^2 Ex$ (2) q Ex
(3) $q E^2 x$ (4) $q Ex^2$

**35.** A proton and an alpha particle enter a uniform magnetic field with the same

**velocity. The period of rotation of the alpha particle will be**

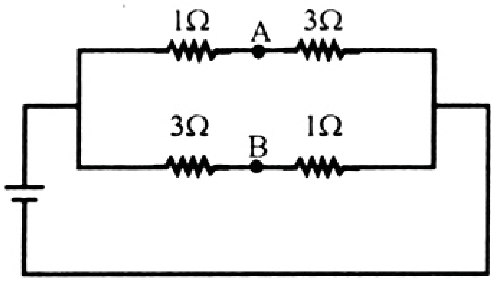
(1) the same as that of proton

(2) three times that of proton

(3) two times that of proton

(4) four times that of proton

**36. A battery of emf 1o V is connected to resistances as shown in the figure. The potential difference between points A and B is**




(1) 5V (2) –2V (3) 2V (4) $\frac{20}{11}$ V

**37. A uniform wire of resistance 4 Ω is bent into the form of a circle of radius r. A specimen of the same wire is connected along the diameter of the circle. What is the equivalent resistance across the ends of this wire ?**

(1) $\frac{1}{(1+\pi)}\Omega$ (2) $\frac{2}{(2+\pi)}\Omega$

(3) $\frac{4}{(4+\pi)}\Omega$ (4) $\frac{3}{(3+\pi)}\Omega$

**38. Two waves are represented by the following equations :**

$$- y_1 = 5 \sin 2\pi\,(10\,t - 0.1\,x)$$

$$\text{and } y_2 = 10 \sin 2\pi\,(20\,t - 0.2)\,x)$$

**The ratio of intensities $I_2/I_1$ will be**

(1) 16 (2) 4 (3) 2 (4) 1

**39. The wavelength of light of a particular wavelength received from a galaxy is measured one earth and is found to be 5% more that its wavelength. It follows that the galaxy is**

(1) going away from the earth with a speed $1.5 \times 10^7\ ms^{-1}$

(2) approaching the earth with a speed $1.5 \times 10^7\ ms^{-1}$

(3) going away from the earth with a speed $3 \times 10^7\ ms^{-1}$

(4) approaching the earth with a speed $3 \times 10^7\ ms^{-1}$

**40. Two rods of the same length and material transfer a given amount of heat in 12 seconds when they are joined end to end. But when they are joined lengthwise, they will transfer the same amount of heat, in the same conditions, in**

(1) 1.5s (2) 48s (3) 24s (4) 3s

**41. A soap bubble is vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4cm. If the two bubbles coalesce under isothermal conditionals the radius of the new bubble will be**

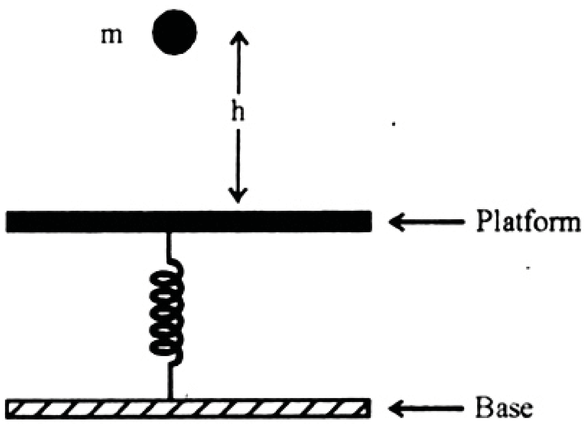
(1) 7 cm (2) 5 cm

(3) 4.5 cm (4) 2.3 cm

**42. A concrete sphere of radius R has a cavity of radius r which is packed with sawdust. The relative densities of concrete and sawdust are 2.4 and 0.3 respectively. For this sphere to float with its entire volume submerged under water, the ratio of the mass of concrete to the mass of sawdust will be**

(1) zero (2) 3 (3) 4 (4) 8

**43.**




**A body of mass m = 1 kg is dropped from a height h = 40 cm on a horizontal platform fixed to one end of an elastic spring, the other being fixed to a base,**

**as shown in figure. As a result the spring is compressed by an amount x = 10 cm. What is the force constant of the spring. Take g = 10 ms$^{-2}$.**

(1) 1200 Nm$^{-1}$ (2) 1000 Nm$^{-1}$
(3) 800 Nm$^{-1}$ (4) 600 Nm$^{-1}$

**44. Choose the correct statement(s) from the following :**

(1) The relative velocity of two bodies in a head - on collision remains unchanged in magnitude and direction

(2) The general form of Newton's second law of motion is $F_{ext}$= ma

(3) A body can have energy and yet no momentum

(4) None of the above.

**45. A body of mass 0.5 kg is whirled in a vertical circle at an angular frequency of 10 rad s$^{-1}$.If the radius of the circle is 0.5 m, what is the tension in the string when the body is at the top of the circle ? Take g = 10 ms$^{-2}$.**

(1) 40 N (2) 30 N (3) 20 N (4) 10 N

**46. A body thrown along a frictionless inclined plane of angle of inclination 30°covers a distance of 40 m along the plane. If the body is projected with the same speed at angle of 30° with the ground, it will have a range of (take g = 10 ms$^{-2}$)**

(1) 40 m (2) 20 m
(3) 20 $\sqrt{3}$m (4) 20 $\sqrt{2}$ m

**47. Which one of the following relations is dimensionally consistent ? A liquid of coefficient of viscosity η is flowing steadily through a capillary tube of radius r and length l. If is the volume of the liquid flowing per second, the pressure difference pat the ends of the tube is given by**

(1) $p = \frac{8\beta lV}{\pi r^4}$ (2) $p = \frac{8\eta r^4 l}{\pi V}$

(3) $p = \frac{8\pi lV}{\eta r^4}$ (4) $p = \frac{8\pi r^4 V}{\pi l}$

**48. The electric current passing thorough a metallic wire produces heat because of**

(1) Collisions of the conduction electrons with the atoms of the metallic wire

(2) The energy released in the ionization of the atoms of the metal

(3) Collisions of conduction electrons with each other

(4) Collisions of the atoms of the metal with each other.

**49. Two parallel wires in free space are 10 cm apart and each carries a current of 10 A in the same direction. The force one wire exerts on the other per metre of length is**

(1) 2 × 10$^{-7}$ N,, repulsive

(2) 2 × 10$^{-7}$ N, attractive

(3) 2 × 10$^{-4}$ N, repulsive

(4)2 × 10$^{-4}$ N, attractive

**50. Vector C is the sum of two vector A and B and vector D is the cross product of vectors A and B. What is the angle between vectors C and D?**

(1) 180° (2) 90° (3) 60° (4) zero

§ ***Directions : Q.No 51 to 60 consists of two statements, one labelled the 'Assertion (A)' and the other labelled the 'Reason (R)'. Examine these statements carefully and decide if***

(1) If both assertion and reason are true statements and the reason is a correct explanation of the assertion

(2) If both assertion and reason are true statements but reason is not a correct explanation of the assertion

(3) If the assertion is true but the reason is a false statement

(4) If both assertion and reason are false statements

51. **Assertion (A) :** Soft magnetic materials (e.g. iron) have a high coercivity and do not demagnetise easily

**Reason (R) :** Hard magnetic materials (e.g. steel) have a low coercivity and become temporary magnets

(1) (2) (3) (4)

52. **Assertion (A) :** Dielectric loss is the energy transformation which occurs in a dielectric in an alternating electric field

**Reason (R) :** The alternating displacement has a cooling effect.

(1) (2) (3) (4)

53. **Assertion (A) :** In Thomson's experiment all the positive ions with the same value of specific charge are focused on the same parabola irrespective of their velocities.

**Reason (R) :** The ions of same velocities arrive at different points on the same parabola

(1) (2) (3) (4)

54. **Assertion (A) :** The velocity of an electron in an orbit is inversely proportional tot he square of the radius of the orbit

**Reason (R) :** The angular velocity of the electron is proportional to the radius of the orbit.

(1) (2) (3) (4)

55. **Assertion (A) :** Reciprocal of resistivity is called the specific conductance.

**Reason (R) :** Reciprocal of resistance is called the thermal conductivity

(1) (2) (3) (4)

56. **Assertion (A) :** Germanium is a very god conductor of electricity

**Reason (R) :** The number of density of free electrons for germanium is $8 \times 10^{28}\ m^{-3}$.

(1) (2) (3) (4)

57. **Assertion (A) :** Illuminance is the luminous flux per unit surface area, when the area is held normal to the beam of light

**Reason (R) :** The luminous intensity of the radiant flux per unit angle in that direction.

(1) (2) (3) (4)

58. **Assertion (A) :** Pressure cooker is useful at high mountains

**Reason (R) :** due to low atmospheric pressure on high mountains the water boils at above 100°C

(1) (2) (3) (4)

59. **Assertion (A) :** The Paschen series in the spectrum of hydrogen lies in the ultraviolet region

**Reason (R) :** The Paschen series is born of transitions of electrons onto the second orbit from higher orbits

(1) (2) (3) (4)

60. **Assertion (A) :** Many solids have a molar heat capacity close to $25\ Jmol^{-1}k^{-1}$

**Reason (R) :** The molar heat capacity is the heat capacity per mole

(1) (2) (3) (4)

# ANSWERS WITH HINTS & EXPLANATIONS

1. Ans. (4) Let us suppose that cars A and B are moving in the positive x-direction. Then car C is moving in the negative x-direction.
Therefore ,

$$v_A = +36\ \text{km h}^{-1} = +10\ \text{ms}^{-1},$$

$$v_B = +54\ \text{km h}^{-1} = +15\ \text{ms}^{-1}$$

and $$v_C = -54\ \text{km Kmh}^{-1} = 15\ \text{ms}^{-1}$$

The relative velocity B with respect to A is

$$v_{BA} = v_B - v_A = 15 - 10 = 5\ \text{ms}^{-1}$$

The relative velocity of C with respect to A is

$$v_{CA} = v_C - v_A = -15 - 10 = -25\ \text{ms}^{-1}.$$

At time t = 0, the distance between A and B = distance between A and C = 1 km = 1000 m. The car C will cover a distance AC = 1000 m and just each car A at a time t given by

$$t = \frac{AC}{|v_{CA}|} = \frac{1000\ \text{m}}{25\ \text{ms}^{-1}} = 40\ \text{s}$$

Car B will overtake car A just before car C does and avoid an accident,
if it acquires a minimum acceleration a such that it covers a distance
s = AB = 1000 m in time t = 40 s, travelling at a relative speed u

$$u = v_{BA} = 5\ \text{ms}^{-1}.$$

Putting these values in relation

$$s = ut + \frac{1}{2}at^2$$

We get $$1000 = 5 \times 40 + \frac{1}{2} \times a \times (40)^2$$

which gives $a = 1\ \text{ms}^{-1}$ which in choice (4)

2. Ans. (3) Momentum mv increases by 20% if velocity v increases 1.2 v. No, kinetic energy $K = \frac{1}{2}mv^2$.

$$\text{Increase in KE} = \frac{1}{2}m(1.2v)^2 - \frac{1}{2}mv^2$$

$$= \frac{1}{2}mv^2(1.44 - 1)$$

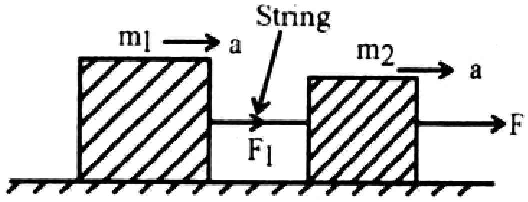
$$= 0.44 \times \frac{1}{2}mv^2 = 0.44\ K.$$

$\therefore$ Percentage increase in

$$KE = \frac{0.44\ K}{K} \times 100 = 44\%$$

Hence the correct choice is (3)

3. Ans. (4)




Refer to the figure. Let f be the frictional force on eachblock. Equations (i) and (ii) are modified to

$$m_1 = a = T - f \text{ - - - - - (i)}$$

and $$m_2a = F - T - f \text{ - - - - - (ii)}$$

Subtracting the two equations, we have

$$(m_1 - m_2)\,a = 2T - F$$

Since $m_1 = m_2$,

we get $0 = 2T - F$

or $$T = \frac{F}{2} = \frac{20}{2} = 10\ \text{N}$$

Hence , the correct choice is (4) .

4. Ans. (1) Let h be the vertical height of the staircase. Work done by P is

$$W_1 = m_1gh = 80\ gh$$

Therefore power developed by P is

$$P_1 = \frac{W_1}{t_1} = \frac{80\ gh}{12}$$

Similarly, power developed by Q is

$$P_2 = \frac{W_2}{t_2} = \frac{60\ gh}{11}$$

which give $P_1/P_2 = 11/9$.

Hence the correct choice is (1)

5. Ans. (2) Since the two atoms have the same mass, the centre of mass is at a distance of a/2 from each atom. Therefore, the moment of inertial of the molecule about its centre of mass is

$$I = m\left(\frac{a}{2}\right)^2 + m\left(\frac{a}{2}\right)2 = \frac{ma^2}{2}$$

Hence the correct choices is (2) .

6. Ans. (1) The centripetal force is provided by the gravitational attraction of the earth. Hence the correct choice is (1).

7. Ans. (2) When stones are unloaded into the water in the tank, the volume of water displaced is equal to the volume of the stones. This is less than the volume of water having weight equal to the weight of stones because the density of stones is greater than that of water. Hence the water level falls, which is choice (2)

8. Ans. (1) Mass of water in first tube is

$$m = \pi r^2 h\rho$$

Now, surface tension

$$\sigma = \frac{h\rho gr}{2} = \frac{h\rho gr'}{2}$$

where $h'$ is the height to which water rises in the second tube and $r'$ its radius. Since $r' = 2r$, $h' = h/2$

Therefore, the mass of water in the second capillary tube is

$$m' = \pi r'^2 h'\rho = \pi (2r)^2 \frac{h}{2} \rho$$

$$= 2\pi r^2 h \rho = 2m = 2 \times 5 = 10 g$$

Hence the correct choice is (1)

9. Ans. (2) Here $l_1 = \frac{FL_1}{\pi r_1^2 Y}$

and $\quad l_2 = \frac{FL_2}{\pi r^2{}_2 Y}$

Therefore , $\quad \frac{l_1}{l_2} = \frac{L_1}{L_2} \times \left(\frac{r_2}{r_1}\right)^2$

Given $\quad L_2 = 2L_1$ and $r_2 = \frac{r_1}{2}$

Thus, $\quad \frac{l_1}{l_2} = \frac{1}{2} \times \frac{1}{(2)^2} = \frac{1}{8}$

10. Ans. (2) The latent heat of vaporization of water is very nearly 540 calories per gram. Therefore heat released in the condensation of x gram of steam = 540 x calories. The latent heat of fusion of ice is very nearly 80 calories. Therefore, heat required to convert y gram of ice at $0^\circ C$ to water at

$$100^\circ C = 80 + y + 100\, y$$
$$= 180 y \text{ calories}$$

Thus $\quad 180\, y = 540x$

or $\quad \frac{y}{x} = 3$

Hence the correct choice is (2)

11. Ans. (3) $PV^\gamma = \text{constant}$

12. Ans. (2) If a force F is applied to a spring of force constant k and the spring extends by an amount x, then F = kx

The extension x produced in a spring is proportional to its length. Thus, if the spring is cut into three equal pieces, the same force F will produce an extension x/3 in a piece. If $k'$ is the is the force constant of the piece, we have

$$F = k' x/3$$

Therefore $\quad \frac{k'}{3} = k$

or $\quad k' = 3k$

Thus, the force e constant of each piece is 3k. When springs are connected in parallel, the force constant of the combination is equal to the sum of the individual force constants of the springs so connected. Therefore, the force constant of the combination = 3k + 3k + 3k = 9k. Hence correct choice is (2).

13. Ans. (4) The speed of sound wave in the rod is

$$v = \sqrt{Y/\rho} = \sqrt{\frac{2 \times 10^{11}}{8000}} = 5000 \text{ ms}^{-1}$$

$\therefore$ Time taken is $= 1/5000 = 2 \times 10^{-4}$ s.

Hence the correct answer is (4)

14. Ans. (1) Electric field

$$E = -\frac{dV}{dx} = -\frac{d}{dx}(5 + 4x^2) = -8x$$

Force on charge $(-q) = -q E = +8q x$

At x = 0.5 m, force $= 8 \times 2 \times 10^{-6} \times 0.5$

$$= 8 \times 10^{-6} N$$

15. Ans. (1)

The drift speed of electrons is given by

$$v_d = \frac{1}{enA}$$

If l is the length of the wire, the taken is

$$t = \frac{l}{v_d} = \frac{l\,e\,n\,A}{I}$$

$$= \frac{1 \times 1.6 \times 10^{-19} \times 8 \times 10^{28} \times 5 \times 10^{-7}}{1}$$

$$= 6.4 \times 10^3 \text{ s}$$

16. Ans. (3) The maximum power rating of a resistance is the maximum power it can dissipate without melting. If a 20 Ω resistor is connected to a 50 V dc source, the power dissipated as heat is

$$P = \frac{V^2}{R} = \frac{50 \times 50}{20} = 125 \text{ W}$$

which is less than 1 kW. Hence the resistor can be safely used across a 50 V source. For 150 V and 200 V dc sources, the powers dissipated respectively are 1.125 kW and 2 kW. Now 1.125 kW and 2 kW are more than the maximum power rating of the resistor. Hence the correct choices are (3).

17. Ans. (2) $T = m\omega^2 = 0.1 \times 4\pi^2 \times \frac{5}{\pi^2} = 2\text{N}$

18. Ans. (2) Force F = qvB

$$\therefore \text{ Acceleration} = \frac{F}{m} = \frac{qvB}{m}$$

$$= \frac{1.6 \times 10^{-19} \times 5.0\ 10^5 \times 0.17}{1.7 \times 10^{-27}}$$

$$= 8 \times 10^{12}\ \text{ms}^{-2}$$

Hence the correct answer is (2) .

19. Ans. (2) The straight portions of the wire do not contribute because the point P is along them. The field at P is due to 3/4th of the lope of radius r. Then

$$B = \frac{3}{4}\left(\frac{\mu_0 I}{2r}\right) = \frac{3}{4} \times \frac{4\pi \times 10^{-7} \times 40}{3.14 \times 10^{-2}}$$

$$= 4.8 \times 10^{-3}\ \text{T}$$

20. Ans. (4) Path difference $\Delta = \lambda$.

Therefore, phase difference $\phi = \frac{2\pi}{\lambda}\Delta = 2\pi$.

Hence intensity at a point where $\Delta = \lambda$

or $\phi = 2\pi$ is

$$I = I_1 + I_2 + \sqrt{I_1 I_2} \cos\phi$$

$$= I_1 + I_2 + 2\sqrt{I_1 I_2} \cos 2\pi$$

$$= I_1 + I_2 + 2\sqrt{I_1 I_2}$$

$$= I + I + 2I = 4I = K \text{ units}$$

$(\because\ I_1 = I_2 = I)$ i.e. $I = K/4$.

The intensity at a point where the path difference is

$$\Delta' = \frac{\lambda}{3}$$

or $\phi' = \frac{2\pi}{\lambda}\Delta' = \frac{2\pi}{\lambda} \times \frac{\lambda}{3} = \frac{2\pi}{3}$

$$\therefore\ I' = I + I + 2I \cos\frac{2\pi}{3}$$

$$= 2I - I = I = \frac{K}{4} \text{ units}$$

21. Ans . (1) E = 12 lux and r = 0.5 m. Luminous intensity $I$ is related to E as

$$E = \frac{I}{r^2}$$

or $I = Er^2 = 12 \times (5.0)^2 = 300$ cd

22. Ans. (2)The radius of the circular path is

$$r = \frac{mv}{eB} = \frac{v}{B\,(e/m)}$$

$$= \frac{5.28 \times 10^6}{2 \times 10^{-4} \times 1.76 \times 10^{11}}$$

$$= 0.15 \text{ m} = 15 \text{ cm}$$

23. Ans. (4) The maximum wavelength of visible light is about 800 Å (the red end of the visible spectrum).

The energy of a photon of wavelength

$$\lambda = 8000\ \text{Å} = 8 \times 10^{-7} \text{ m is}$$

$$E = h\nu = \frac{hc}{\lambda} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{8 \times 10^{-7}}$$

$$= 2.5 \times 10^{-19}\ \text{J} = 1.5\text{eV}$$

24. Ans. (2) A black hole has a very small size but enormous surface gravity, so much so that even light signal (photon ) cannot escape from its surface. Hence the correct choice is (2)

25. Ans. (2) When the reverse bias voltage is increased, a stage is reached when the charge carriers (electrons and holes) are accelerated by the reverse bias voltage and acquire kinetic energy so as to break the covalent bonds in the semiconductor by collisions. The free electrons can do the same and a rapidly increasing number of energetic electrons are produced. Consequently, the reverse current increases very rapidly. Hence the correct answer is (2).

26. Ans . (3) $\overline{1} + \overline{1} = 0 + 0 = 0$.

27. Ans. (4)

28. Ans. (2) $\beta$ - particle is an electron. When a $\beta$ – particle is emitted from a nucleus, the charge number increases by unity, i.e. the number of protons increases by unity. Also the number of neutrons decreases. Hence the neutron - proton ratio decreases

29. Ans. (2) Alpha rays are positively charged helium nuclei and beta rays are negatively charged electrons.

30. Ans. (4) Statement (4) is incorrect. In fact A = Z + N. Statements (1), (2) and (3) are correct, they are the definitions of isobars, isotopes and isotones.

31. Ans. (3) $\beta$ - particle is an electron. Since electron has the smallest mass, its de Broglie wavelength is the longest as the velocity of all particles is the same.

32. Ans. (4) A concave lens in contact with a plane mirror behaves like a convex mirror because the combination forms only virtual image for any position of the object. The focal length F of the equivalent convex mirror is given by

$$\frac{1}{F} = \frac{2}{f} + \frac{1}{f_m} = \frac{2}{f} \quad (\because f_m = \infty)$$

or $$F = \frac{f}{2} = \frac{20}{2} = 10\,\text{cm}$$

Hence the correct choice is (4)

33. Ans. (4) Since $\frac{1}{v} = -\frac{1}{u} + \frac{1}{f}$, the graph of $\frac{1}{v}$ against $\frac{1}{u}$ is a straight line with a negative slope. Hence the correct choice is (4)

34. Ans. (2) Initial kinetic energy of the particle is zero. The gain in kinetic energy in distance x = decrease in potential energy = work done by the electric field to move the particle through a distance x = force × distance = qEx. Hence the correct answer is (2).

35. Ans. (3) The time period of a particle of mass m, charge q moving in a circular path in a magnetic field B is given by

$$T = \frac{2\pi m}{qB}$$

For proton $$T_p = \frac{2\pi m_p}{q_p B}$$

For $\alpha$ - particle $$T_a = \frac{2\pi m_\alpha}{q_\alpha B}$$

$$\therefore \quad \frac{T_\alpha}{T_p} = \frac{m_\alpha}{m_p} \times \frac{q_p}{q_\alpha}$$

Now $q_n\alpha = 2q_p$ and $m_c = 4m_p$

Hence $T_\alpha / T_p = 2$

Hence the correct choice is (3)

36. Ans. (1) The total resistance of the circuit t is given by

$$\frac{1}{R} = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

which gives $R = 2\Omega$. Therefore , the current in the circuit is

$$I = \frac{V}{R} = \frac{10}{2} = 5\,\text{A}$$

37. Ans. (3) Circumference of the circle $= 2\pi r$. Therefore , the resistance per unit length of the wire $= R/2\pi r$, where $R = 4\Omega$ is the resistance of the wire. Now, the length of the specimen connected along the diameter = 2r. Therefore, the resistance of this specimen is

$$R_1 = \frac{R}{2\pi r} \times 2r = \frac{R}{\pi}$$

Also, the resistance of each semicircle is

$$R_2 = \frac{R}{2}$$

$\therefore$ Equivalent resistance R' across the specimen is given by

$$\frac{1}{R'} = \frac{2}{R} + \frac{\pi}{R} = \frac{4+\pi}{R}$$

or $$R' = \frac{R}{4+\pi} = \frac{4}{4+\pi}\,\Omega$$

38. Ans. (1) The intensity of wave is given by

$$I = \frac{1}{2}\rho v A^2 \omega^2$$

$$\therefore \quad \frac{I_1}{I_2} = \frac{A_1^2\,\omega_1^2}{A_2^2\,\omega_2^2}$$

Here $A_1 = -5$ units, $A_2 = 10\ 10$ units,

$\omega_1 = 2\pi\,(10)$ and $\omega_2 = 2\pi\,(20)$

$$\therefore \quad \frac{I_1}{I_2} = \left(\frac{-5 \times 10\,\pi}{10 \times 4\pi}\right)^2 = \frac{1}{16}$$

Hence the correct choice is (1)

39. Ans. (1) If a source emitting light of wavelength $\lambda$ goes away from the earth, the apparent wavelength $\lambda'$ of the light reaching the earth is given by

$$\frac{\lambda'}{\lambda} = 1 + \frac{v}{c}$$

where v is the speed of the source of light and c the speed of light. The increase in wavelength $\Delta\lambda = \lambda' - \lambda$ is given by

$$\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$$

Here $$\frac{\Delta\lambda}{\lambda} = 5\% = \frac{5}{100} \text{ and}$$

$$= 3 \times 10^8\ \mathrm{ms^{-1}}$$

Therefore, $$v = 3 \times 10^8 \times \frac{5}{100}$$

$$= 1.5 \times 10^7\ \mathrm{ms^{-1}}$$

Hence the correct choice is (1)

40. Ans. (2) Let Q be the heat transferred. If k is the thermal conductivity of each rod, their equivalent conductivity, when they are joined in series (end to end) is 2k. If t is time of transfer of heat, then

$$Q_1 = \frac{(2k)\,A\,\Delta\theta t_1}{l}$$

If the rods are joined in parallel ( length wise) the equivalent conductivity is k/2

Hence $$Q_2 = \frac{\left(\frac{k}{2}\right) A\,\Delta\theta t_2}{l}$$

Now $Q_1 = Q_2$ (given)

Therefore $$\frac{2kA\Delta\theta t_1}{l} = \frac{kA\Delta\theta t_2}{2l}$$

or $$t_2 = 4t_1 = 4 \times 12 = 48\,\mathrm{s}$$

Hence the correct answer is (2).

41. Ans. (3) In vacuum, there is no atmospheric pressure. The pressure in only due to surface tension. Now, total volume of the two bubbles = volume of the big bubble. If $r_1$ and $r_2$ are the radii of the two bubbles and R that of the big bubble, then

$$\frac{4\pi}{3}R^3 = \frac{4\pi}{3}r_1^3 + \frac{4\pi}{3}r_2^3$$

or $$R^3 = r_1^3 + r_2^3 = (3)^3 + (4)^3 = 91\ \mathrm{cm}^3$$

which gives R = 4.5 cm. Hence the close choice is (2)

42. Ans. (3) Let m be the mass of concrete and $\rho$ its density and let $m'$ be the mass of sawdust and $\rho'$ its density. Then

$$m = \frac{4\pi}{3}(R^3 - r^3)\,\rho$$

and $$m' = \frac{4\pi}{3}r^3\rho'$$

$$\therefore \quad \frac{m}{m'} = \frac{R^3 - r^3}{r^3}\cdot\frac{\rho}{\rho'}$$

Since the entire volume $V = \frac{4\pi}{3}R^3$ of the sphere is submerged under water, we have from the principle of flotation, Weight of concrete + weight of sawdust = weight of volume V of water displaced

or $\quad mg + m'g = V\rho_0 g$

or $\quad m + m' = V\rho_0$

where $\rho_0$ is the density of water.

Thus $\quad \frac{4\pi}{3}(R^3 - r^3)\,\rho + \frac{4\pi}{3} r^3 \rho' = \frac{4\pi}{3} R^3 \rho_0$

or $\quad (R^3 - r^3)\, d + r^3 d' = R^3$

where $d = \rho/\rho_0$ are the relative densities of concrete and sawdust respectively. Equation (ii), on simplification, gives

$$\frac{R^3}{r^3} = \frac{(d - d')}{(d - 1)}$$

or $$\frac{R^3}{r^3} - 1 = \frac{(d - d')}{(d - 1)} - 1$$

or $$\frac{R^3 - r^3}{r^3} = \frac{(1 - d')}{(d - 1)}$$

Using (iii) in (i) and noting that $\frac{\rho}{\rho'} = \frac{d}{d'}$, we have

$$\frac{m}{m'} = \frac{(1 - d')}{(d - 1)} \times \frac{d}{d'}$$

$$= \frac{(1 - 0.3)}{(2.4 - 1)} \times \frac{2.4}{0.3} = 4$$

Hence the correct choice is (3)

43. Ans. (2) Since the platform is depressed by an amount x, the toward work done on the spring is mg (h + x). This work is stored in the spring n the form of potential energy $\frac{1}{2}kx^2$. Equating the two , we have

$$\frac{1}{2}kx^2 = mg\,(h + x)$$

or $$k = \frac{2mg\,(h + x)}{x^2}$$

Given, h = 0.4m, m = 1 kg and $g = 10\ ms^{-2}$.

Substituting these values, we get

$$k = 1000\ Nm^{-1}.$$

Hence the correct choice is (2).

44. Ans. (3) The general form of Newton's second law is

$$F_{ext} = \frac{dp}{dt} = \frac{d}{dt}(mv) = \frac{mdv}{dt} + v\frac{dm}{dt}$$

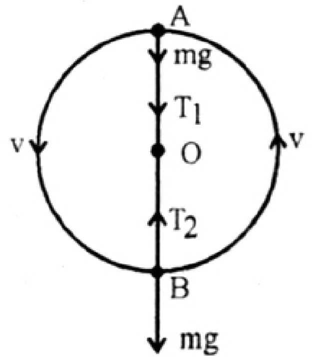
The form $F_{ext} = ma$ is valid only if $\frac{dm}{dt} = 0$,

i.e. if mass does not change with time. Hence choice (2) is incorrect. Choice (3) is correct because body at rest may have potential energy and yet no momentum. Choice (1) Is incorrect because the relative velocity remains unchanged in magnitude and gets reserved in direction : $(v_2 - v_1) = -(u_2 - u_1)$.

45. Ans. (3) It is clear from below figure , what when the body at the top point A of the circles, its weight mg and tension $T_1$ in the stirring act downwards towards the centre O of the circle and the sum of the two provides the necessary centripetal force. Thus

$$T_1 + mg = mR\omega^2$$

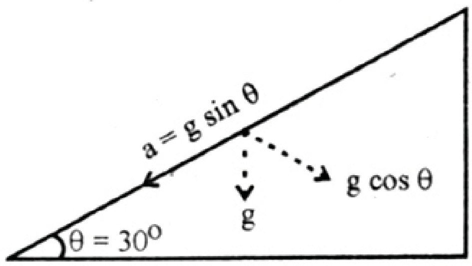
or $$T_1 = m\,(R\omega^2 - g)$$




$$= 0.5 \times (0.5 \times 10^2 - 10) = 20\ N$$

Thus, the correct choice is (3) .

46. Ans . (3) Let u be the initial speed with which the body is thrown along the incline plane.



As shown in figure, the effective deceleration is given by

$$a = g \sin\theta = g \sin 30^o = \frac{g}{2} = 5 \text{ ms}^{-2}$$

The body stops after converting a distance, say , s along the plane, which is given by

$$-2as = 0 - u^2$$

or $$u = \sqrt{2as} = \sqrt{2 \times 5 \times 40} = 20 \text{ ms}^{-1}$$

A projectile projected at angle $\theta = 30^o$ with this speed will have a angle of

$$R = \frac{u^2 \sin 2\theta}{g}$$

$$= \frac{20 \times 20 \times \sin 60^o}{10} = 20\sqrt{3}\,\text{m}$$

Hence the correct is (3)

47. Ans. (1) Using the dimensions of all quantities involved it is easy to check that the correct choice is (1).

48. Ans. (1) Colliding electrons lose their kinetic energy as heat.

49. Ans. (4) $F = \frac{\mu_0}{4\pi}\frac{2i_1i_2}{r} = 10^{-7} \times \frac{2 \times 10 \times 10}{0.1}$

$$= 2 \times 10^{-4}\text{ N}$$

Direction of current is same, so force is attractive.

50. Ans. (2) Vector C lies in the plane containing vectors A and B, an vector D is perpendicular to both A and B. Hence D must be perpendicular to C. Hence the correct choice is (2).

51. Ans. (4) Soft magnetic materials (e.g. iron) have a low coercivity and demagnetise easily. Hart magnetic materials (e.g., steel) have a high coercity and become permanent magnets

52. Ans. (3) The alternating displacement causes thermal motion; it has a heating effect.

53. Ans. (3) Ions of different velocities arrive at different points on the parabola.

54. Ans. (4) The velocity of electron $v_n = \frac{nh}{2\pi r_n}$

$$\Rightarrow \quad v_n \propto \frac{1}{r_n}$$

The angular velocity of electron

$$\omega_n = \frac{nh}{2\pi m r_n^2}$$

$$\Rightarrow \quad \omega_n \propto \frac{1}{r_n^2}$$

55. Ans. (3)

Specific conductance

$$= \frac{1}{\text{specific resistance or resistivity}}$$

56. Ans. (4) Germaniumisasemiconductor. $8 \times 10^{28}\text{ m}^{-3}$ is the number density of free electrons for copper and not for germanium.

57. Ans. (3) Luminous intensity of a source in a given direction is defined as the luminous flux per unit solid angle (not angle) in that direction.

58. Ans. (3) Due to low atmospheric pressure on the mountains the water boils at below 100°C

59. Ans. (4) Paschen series is formed when an atom comes down from higher energy levels to the third energy level. The series is found in the infra-red region of the spectrum

60. Ans. (2)

# AIIMS-2001 (Part B. Chemistry)

1. Among the following gases which one has the lowest root mean square velocity at 25°C :
(1) $Cl_2$ (2) $O_2$ (3) $N_2$ (4) $SO_2$

2. The molecules of a gas A travel four times faster than the molecules of gas B at the same temperature. The ratio of molecular weights $\left(\frac{M_A}{M_B}\right)$ will be :
(1) 4 (2) 16 (3) 1/4 (4) 1/16

3. The first energy level that can have d - orbitals is :
(1) 3 (2) 2
(3) 4 (4) All are correct.

4. $^{14}_{6}C$ in the upper atmosphere is formed by the action of neutrons on :
(1) $^{18}_{8}O$ (2) $^{12}_{6}C$
(3) $^{17}_{8}O$ (4) $^{14}_{7}N$

5. The relative abundance of two isotopes of atomic weight 85 and 87 is 75% and 25% respectively. The average atomic weight element is :
(1) 86.0 (2) 40.0
(3) 85.5 (4) 75.5

6. The bond energies of $F_2, Cl_2, Br_2$ and $I_2$ are 37, 58, 46 and 36 kcal respectively. The strongest bond is :
(1) $Br_2$ (2) $I_2$
(3) $Cl_2$ (4) $F_2$

7. Which possesses the largest ionic radius :
(1) $Fe^{3+}$ (2) $Fe^{+}$
(3) $Fe^{2+}$ (4) Fe

8. The time required to decrease the rate of decay to half of its value for a reaction, if $T_{1/2}$ = 2 hr is :
(1) 4 hr (2) 3 hr
(3) 2 hr (4) 1 hr

9. Approximate atomic weight of an element is 26.89. If its equivalent weight is 8.9 the exact atomic weight of element would be :
(1) 17.8 (2) 26.7
(3) 26.89 (4) 8.9

10. The reaction $2C + O_2 \rightarrow 2CO_2$ is carries out by taking 24 g carbon and 96 g $O_2$. Which one is limiting reagent :
(1) $CO_2$ (2) C
(3) $O_2$ (4) None

11. Equivalent weight of $NH_3$ in the change is :
$$N_2 \rightarrow NH_3$$
(1) 17/3 (2) 17/2
(3) 17 (4) 17/6

12. An ion is reduced to the element when it absorbs $6 \times 10^{20}$ electrons. The number of equivalents of the ion is :
(1)) 0.01 (2) 0.10
(3) 0.0001 (4) 0.001

13. 100 ml of 0.2 M $H_2SO_4$ is added to 100 ml of 0.2 M NaOH. The resulting solution will be
(1) Neutral (2) Slightly basic
(3) Acidic d) Basic

14. Molal depression of freezing point of water is 1.86° per 1000 g of water. 0.02 mole of urea dissolved in 100 g of water will produce a lowering of temperature of :
(1) 3.72° (2) 1.86°
(3) 0.372° (4) 0.186°

15. If $n_1$, $n_2$ are moles of solute and solvent respectively. Raoult's law can be expressed as :
(1) $\frac{P_o - P_s}{P_o} = \frac{n_2}{n_1 + n_2}$ (2) $\frac{P_o}{P_s} = \frac{n_2}{n_1 + n_2}$
(3) $P_s/P_o = \frac{n_2}{n_1 + n_2}$ (4) none

**16. Which oxide of nitrogen is the most stable :**

(1) $2N_2O\ (g) \rightleftarrows 2N_2\ (g) + O_2\ (g);$
$K = 3.5 \times 10^{33}\ mol\ litre^{-1}$

(2) $2N_2O_5\ (g) \rightleftarrows 2N_2(g) + 5O_2\ (g);$
$K = 1.2 \times 10^{34}\ mol^{-5}\ litre^{-5}$

(3) $2NO_2\ (g) \rightleftarrows N_2(g) + 2O\ (g);$
$K = 6.7 \times 10^{16}\ mol litre^{-1}$

(4) $2NO\ (g) \rightleftarrows N_2\ (g) + O_2\ (g);$
$K = 2.2 \times 10^{30}\ mol\ litre^{-1}$

**17. HI was heated in a sealed tube at 440°C till the equilibrium was reached, HI was fond to be 22% decomposed. The equilibrium constant for dissociation is :**

(1) 1.99 (2) 0.0199
(3) 0.0796 (4) 2.282

**18. Which species does not act as Lewis acid :**

(1) $Cl^-$ (2) $SnF_4$ (3) $SiCl_4$ (4) $AlCl_3$

**19. Some salts although containing two different metallic elements give test for only one of them in solution. Such salts are :**

(1) Complex salts (2) Double salts
(4) Normal salts (4) None

**20. When $K_2O$ is added to water, the solution is basic because it contains a significant concentration of :**

(1) $O_2^{2-}$ (2) $O^{3-}$
(3) $OH^-$ (4) $K^+$

**21. A conductivity cell has two platinum electrodes of 1.2 $cm^2$ area, separated by a distance of 0.8 cm. The cell constant is :**

(1) $1.5\ cm^{-1}$ (2) $0.66\ cm^{-1}$
(3) 0-.66 cm (4) $0.96\ cm^{-1}$

**22. In an adiabatic process :**

(1) There is perfect heart insulation
(2) The gas is isothermally expanded
(3) The system exchanges heat surroundings
(4) Pressure is maintained constant.

**23. If, $H_2(g) + \frac{1}{2} O_2\ (g) \rightarrow H_2O(l)$ – 68.4 kcal. Thus when 1 mole of $H_2O$ is formed from hydrogen and oxygen then 68.4 kcals of heat is :**

(1) Needed for initiating the reaction
(2) Absorbed (3) Evolved
(4) None

**24. Acetic acid is a weak acid because it is :**

(1) Slightly ionised (2) Unstable
(3) An organic acid (4) None

**25. When metal sulphide has maximum solubility in water :**

| | $K_{sp}$ |
|---|---|
| (1) HgS | $10^{-54}$ |
| (2) CdS | $10^{-30}$ |
| (3) FeS | $10^{-20}$ |
| (4) ZnS | $10^{-22}$ |

**26. The phenomenon in which white transparent crystal changes into white powder is known as :**

(1) Deliquescence (2) Efflorescence
(3) Allotropy (4) Sublimation

**27. The percentage by weight of hydrogen in $H_2O_2$ is :**

(1) 5.88 (2) 6.25
(3) 25 (4) 50

**28. On heating quicklime with coke in an electric furnace, we get :**

(1) Ca and $CO_2$ (2) $CaCO_3$
(3) CaO (4) $CaC_2$

**29. A metallic oxide which imparts purple colour to pottery is :**

(1) Manganese dioxide
(2) Sodium oxide (3) Copper oxide
(4) Lead oxide

**30. The component present in greater proportion in water gas is :**

**16. Which oxide of nitrogen is the most stable :**

(1) $2N_2O\ (g) \rightleftarrows 2N_2\ (g) + O_2\ (g)$;
$K = 3.5 \times 10^{33}$ mol litre$^{-1}$

(2) $2N_2O_5\ (g) \rightleftarrows 2N_2(g) + 5O_2\ (g)$;
$K = 1.2 \times 10^{34}$ mol$^{-5}$ litre$^{-5}$

(3) $2NO_2\ (g) \rightleftarrows N_2(g) + 2O\ (g)$;
$K = 6.7 \times 10^{16}$ mol litre$^{-1}$

(4) $2NO\ (g) \rightleftarrows N_2\ (g) + O_2\ (g)$;
$K = 2.2 \times 10^{30}$ mol litre$^{-1}$

**17. HI was heated in a sealed tube at 440°C till the equilibrium was reached, HI was fond to be 22% decomposed. The equilibrium constant for dissociation is :**

(1) 1.99 (2) 0.0199
(3) 0.0796 (4) 2.282

**18. Which species does not act as Lewis acid :**

(1) $Cl^-$ (2) $SnF_4$ (3) $SiCl_4$ (4) $AlCl_3$

**19. Some salts although containing two different metallic elements give test for only one of them in solution. Such salts are :**

(1) Complex salts (2) Double salts
(4) Normal salts (4) None

**20. When $K_2O$ is added to water, the solution is basic because it contains a significant concentration of :**

(1) $O_2^{2-}$ (2) $O^{3-}$
(3) $OH^-$ (4) $K^+$

**21. A conductivity cell has two platinum electrodes of 1.2 $cm^2$ area, separated by a distance of 0.8 cm. The cell constant is :**

(1) 1.5 $cm^{-1}$ (2) 0.66 $cm^{-1}$
(3) 0-.66 cm (4) 0.96 $cm^{-1}$

**22. In an adiabatic process :**

(1) There is perfect heart insulation
(2) The gas is isothermally expanded
(3) The system exchanges heat surroundings
(4) Pressure is maintained constant.

**23. If, $H_2(g) + \frac{1}{2} O_2\ (g) \rightarrow H_2O(l)\ -\ 68.4$ kcal. Thus when 1 mole of $H_2O$ is formed from hydrogen and oxygen then 68.4 kcals of heat is :**

(1) Needed for initiating the reaction
(2) Absorbed (3) Evolved
(4) None

**24. Acetic acid is a weak acid because it is :**

(1) Slightly ionised (2) Unstable
(3) An organic acid (4) None

**25. When metal sulphide has maximum solubility in water :**

| | $K_{sp}$ |
|---|---|
| (1) HgS | $10^{-54}$ |
| (2) CdS | $10^{-30}$ |
| (3) FeS | $10^{-20}$ |
| (4) ZnS | $10^{-22}$ |

**26. The phenomenon in which white transparent crystal changes into white powder is known as :**

(1) Deliquescence (2) Efflorescence
(3) Allotropy (4) Sublimation

**27. The percentage by weight of hydrogen in $H_2O_2$ is :**

(1) 5.88 (2) 6.25
(3) 25 (4) 50

**28. On heating quicklime with coke in an electric furnace, we get :**

(1) Ca and $CO_2$ (2) $CaCO_3$
(3) CaO (4) $CaC_2$

**29. A metallic oxide which imparts purple colour to pottery is :**

(1) Manganese dioxide
(2) Sodium oxide (3) Copper oxide
(4) Lead oxide

**30. The component present in greater proportion in water gas is :**

(1) $CH_4$ (2) $CO_2$
(3) CO (4) $H_2$

**31. A process for making ammonia at high temperature and pressure in the presence of a catalyst is known as :**

(1) Synthesis (2) Gasification
(3) Fractional crystallization
(4) Destructive distillation

**32. $PCl_5$ does not react with :**

(1) $C_2H_5NH_2$ (2) $C_6H_5OH$
(3) $H_2SO_4$ (4) $CH_3COOH$

**33. Which substance chars when warmed with conc. $H_2SO_4$ :**

(1) Carbohydrate (2) Hydrocarbon
(3) Fat (4) Protein

**34. Treatment of $CS_2$ with excess of $Cl_2$ gives :**

(1) $C_2H_5Cl$ (2) $CCl_4$
(3) $CHCl_3$ (4) Carbon black

**35. The blue complex ion formed on addition of conc. $NH_4OH$ solution to a $Cu^{2+}$ salt solution is :**

(1) $[Cu(NH_4)_2]^{2+}$ (2) $[Cu(NH_3)_4]^{2+}$
(3) $[Cu(NH_3)_2]^{2+}$ (4) $[Cu(NH_4)_4]^{2+}$

**36. The number of ions formed on dissolving one molecule of $FeSO_4\,(NH_4)_2SO_4 \cdot 6H_2O$ is :**

(1) 6 (2) 3 (3) 5 (4) 4

**37. Homolytic fission of C - C bond in ethane gives an intermediate in which carbon is .. . . . hybridised :**

(1) $sp^2d$ (2) sp
(3) $sp^2$ (4) $sp^3$

**38. Hydrocarbon liquid at STP is :**

(1) Pentane (2) Butane
(3) Propane (4) Ethane

**39. Which of the following is weakly acidic :**

(1) $CH_3 - C \equiv C - CH_3$
(2) $CH_3 - C \equiv CH$ (3) $CH_2 = CH_2$
(4) $C_6H_6$

**40. Acetylene on reacting with HBr gives :**

(1) Ethylidene dibromide
(2) Ethylene bromide
(3) Ethyl bromide
(4) Methyl bromide

**41. Acrolein is obtained when glycerol dehydrated with :**

(1) $P_2O_5$ (2) $KHSO_4$
(3) Conc. $H_2SO_4$ (4) All are correct.

**42. Acetaldehyde is the rearrangement product of :**

(1) Methyl alcohol (2) Allyl alcohol
(3) Vinyl alcohol (4) Ethyl alcohol

**43. Indicate the organic structure for product expected when 2 - methyl propene is heated with acetyl chloride in presence of anhydrous $ZnCl_2$ :**

(1) $CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{CH_3}{|}}{C} = CH_2$

(2) $CH_3 - \underset{\underset{O}{\|}}{C} - O - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - CH_3$

(3) $CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{Cl}{|}}{C}} - CH_2 - COCH_3$

(4) $CH_3 - \overset{\overset{H}{|}}{\underset{\underset{CH_3}{|}}{C}} - CH_2 - CO - CH_3$

**44. $C_2H_5OH$ can be distinguished from $CH_3OH$ :**

(1) By $NH_3$ (2) By HCl
(3) By solubilities (4) By iodoform test.

**45. Salicylic acid when treated with zinc dust gives :**

(1) Benzoic acid (2) Benzene
(3) Salicylaldehyde (4) Phenol

**46. An example of a water soluble vitamin is :**

(1) Vitamin D (2) Vitamin E

(3) Vitamin A (4) Vitamin C

**47. Which solution will posses the lowest boiling point :**

(1) 1% urea solution

(2) 1% sucrose solution

(3) 1 % glucose solution

(4) 1% NaCl solution

**48. $CO_2$ has ...... hybridization :**

(1) $sp^2$ (2) sp

(3) $sp^3$ (4) None

**49. 1 curie mass ($t_{1/2}$ = 12 hr) left after one week is :**

(1) 120 micro curie (2) 1 curie

(3) 8 milli curie (4) 60 micro curie

**50. The pair of systems having tetrahedral geometry is :**

(1) $Ni(Cl)_2^{2-}$ and $CH_3^-$

(2) $Pt(Cl)_4^{2-}$ and $Ni(CN)_4^{2-}$

(3) $BCl_3$ and $CH_4$

(4) $CH_4$ and $NH_4^+$

§ ***Directions : Q.No 51 to 60 consists of two statements, one labelled the 'Assertion (A)' and the other labelled the 'Reason (R)'. Examine these statements carefully and decide if***

(1) If both assertion and reason are true statements and the reason is a correct explanation of the assertion

(2) If both assertion and reason are true statements but reason is not a correct explanation of the assertion

(3) If the assertion is true but the reason is a false statement

(4) If both assertion and reason are false statements

51. Assertion (A) :When two or more empty orbitals of equal energy are available, one electron must be placed in each until they are all half filled.

Reason (R) : The pairing of electrons is an unfavourable phenomenon.

(1) (2) (3) (4)

52. Assertion (A) : The mineral oil, a mixture of high molecular weight hydrocarbons, is soluble in hexane, but not in alcohol or water.

Reason (R) : The hydrogen bonding in ethanol or water is relatively strong and non-polar molecules cannot overcome these forces.

(1) (2) (3) (4)

53 Assertion (A) : The number of unpaired electrons in $Ni(CO)_4$ is zero

Reason (R) : 4s electrons of nickel atom enter the inner d orbitals to facilitate the $sp^3$ hybridisation in Ni atom.

(1) (2) (3) (4)

54. Assertion (A) : The bleaching of flowers by chlorine is permanent, while that by $SO_2$ is temporary.

Reason (R) : Chlorine bleaches by reduction and sulphur dioxide by oxidation.

(1) (2) (3) (4)

55. Assertion (A) : Allyl free radical is more stable than the simple alkyl free radicals.

Reason (R) : The allyl free radical is more stabilised due to the presence of resonance.

(1) (2) (3) (4)

56. Assertion (A) : Nitration of aniline can only be done by protecting $-NH_2$ group by acetylation.

Reason (R) : Acetylation of aniline results in the increase of electron density at benzene ring.

(1) (2) (3) (4)

57. Assertion (A) : Stannous chloride gives grey precipitate with mercuric chloride, but stannic chloride does not do so.

Reason (R) : Stannous chloride is a powerful oxidising agent which oxidises mercuric chloride to metallic mercury.

(1) (2) (3) (4)

58. Assertion (A) : Transition metal, Mn atom loses ns electrons first during ionization as compared to (n−1)d electrons.

Reason (R) : The effective nuclear charge experienced by (n−1)d electrons is greater than that by ns electrons.

(1) (2) (3) (4)

59. Assertion (A) : Technetium-99 is the most common nucleide used in medicine.

Reason (R) : Tc-99 is a breakdown product of Mo-99

(1) (2) (3) (4)

60. Assertion (A) : The rate equation for a general chemical reaction,

$aA + bB \rightleftharpoons cC + dD$

can be expressed as

Rate = $k[A]^x[B]^y$

Reason (R) : The exponents x and y in rate equation are necessarily equal to coefficients a and b respectively.

(1) (2) (3) (4)

## ANSWERS WITH HINTS & EXPLANATIONS

**1**. Ans. (1) . $r \propto \sqrt{\left[\frac{1}{M}\right]}$

**2**. Ans. (4) $u_1/u_2 = \sqrt{\left[\frac{M_2}{M_1}\right]}$

**3**. Ans. (1) The 3rd shell as well as all higher shells have d - subshells.

**4**. Ans. (4) ${}_7N^{14} + {}_0n^1 \rightarrow {}_6C^{14} + {}_1H^1$

**5**. Ans. (3) Av. atomic weights

$$= \frac{85 \times 75 + 87 \times 25}{100} = 85.5$$

**6**. Ans. (3) Greater the bond energy, stronger is bond.

**7**. Ans. (4) Cations are always smaller in size than their parent atom.

**8**. Ans. (3) Rate $\propto$ no. if $N_0 = N/2$;

Rate = rate /2

**9**. Ans. (2)) Valence $= \frac{26.89}{8.9} = 3$

$\therefore$ Exact at. wt. $= 8.9 \times 3 = 26.7$

**10**. Ans. (2) Limiting reagent is one which is completely consumed in reaction.

**11**. Ans. (1) $6e + N_2^0 \rightarrow 2N^{3-}$

**12**. Ans. (4) $6 \times 10^{23}$ electron = 1 eq.

**13**. Ans. (3) Meq. of acid $= 100 \times 0.2 \times 2 = 40$

Meq. of Alkali $= 100 \times 0.2 = 20$;

$\therefore$ Meq. of acid left $= 40 - 20 = 20$

**14**. Ans. (3)

$$\Delta T_f = \frac{1000 \times 1.86 \times 0.02}{100} = 0.372^\circ C$$

**15**. Ans. (3) $P_s = P_o \times$ Mole fraction of solvent

**16**. Ans. (3) Lower is the value of K, lesser will be the tendency to show forward reaction.

**17**. Ans .(2) $2H \rightleftharpoons H_2 + I_2$;

$$K_c = \frac{\alpha^2}{4(1-\alpha)^2};$$

Where $\alpha$ is degree of dissociation,

Also $\alpha = \frac{22}{100}$

$\therefore$ $K_c = 0.0199$

**18.** Ans. (1) $Cl^-$ cannot accept lone pair of electron due to complete octet.

**19.** Ans. (1) e.g., $K_4Fe(CN)_6$ does not give test for $Fe^{3+}$ ions.

**20.** Ans. (3) $K_2O + H_2O \rightarrow 2KOH$

**21.** Ans. (2)

Cell constants $= \frac{l}{a} = \frac{0.8}{1.2} = 0.66\ cm^{-1}$

**22.** Ans. (1)No exchange of heat in between system and surroundings.

**23.** Ans. (3) $\Delta H = -$ ve and thus heat is given out.

**24.** Ans. (1) Acetic acid shows dissociation equilibrium,

$$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$$

**25.** Ans. (3) Higher is $K_{sp}$, more is solubility of salt.

**26.** Ans. (2) The phenomenon of efflorescence involves spontaneous loss of water molecules from a crystal.

**27.** Ans. (1) 34 g $H_2O_2$ has 2 g $H_2$.

**28.** Ans. (4) $2CaO + 5C \rightarrow 2CaC_2 + CO_2$

**29.** Ans. (1) $MnO_2$ imparts puple colour to glass.

**30.** Ans. (4) $H_2$ is about 50 volume in water gas along with 40 volume CO and 5 volume $CO_2$ and $N_2$ each.

**31.** Ans. (1) $N_2 + 3H_2 \xrightarrow{Fe} 2NH_3$ (Haber's synthesis for $NH_4$

**32.** Ans. (1) An important reaction of $PCl_5$ is to replace OH gp. by Cl.

**33.** Ans. (1) $C_{12}H_{22}O_{11} \xrightarrow{H_2SO_4} 12C + 11H_2O$

**34.** Ans. (2) $CS_2 + 2Cl_2 \rightarrow CCl_4 + 2S$

**35.** Ans. (2) The blue coloured complex ion is, $[Cu(NH_3)_4]^{2+}$

**36.** Ans. (3) $Fe^{2+}, 2SO_4^{2-}, 2NH_4^{1+}$

**37.** Ans. (4) $CH_3$ is $sp^3$ hybridized.

**38.** Ans. (1) B.pt. increases with increase in mol. wt.

**39.** Ans. (2) Terminal alkynes have acidic hydrogen.

**40.** Ans. (1) $CH \equiv CH + HBr \rightarrow CH_2 = CHBr \xrightarrow{HBr} CH_3 - CHBr_2$

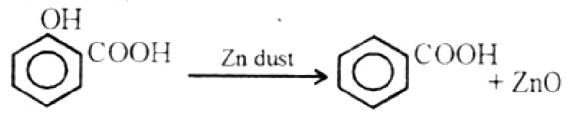
**41.** Ans. (4) All are dehydrating agents.

**42.** Ans. (3) $CH_2 = CH \cdot OH \rightleftharpoons CH_3 \cdot CHO$

**43.** Ans. (3) Addition according to Markownikoff rule.

**44.** Ans. (4) $C_2H_5OH$ gives iodoform test.

**45.** Ans. (1)




**46.** Ans. (4) Water soluble vitamins are B and C.

**47.** Ans. (2) WColligative property

$\Delta T_b = \frac{w \times 1000}{m \times V}(1 - \alpha + x\alpha + y\alpha)$; higher is $\Delta T_b$ more will be b.pt.

**48.** Ans. (2) $CO_2$ is linear molecule.

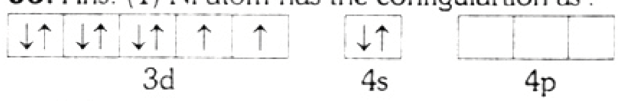
**49.** Ans. (4) Use, $t = \frac{2.303}{K} \log \frac{N_0}{N}$

**50.** Ans. (4) Each has $sp^3$ hybridization.

**51.** Ans. (1) When two or more orbitals of same energy are available for filling each will be singly occupied first according to Hund's rule of maximum multiplicity because to force two electrons is the same orbital needs extra energy as both the electrons are similarly charged.

**52.** Ans. (1) The van der Waals forces between non-polar molecules (as in mineral oil and hexane) are very weak and such molecules can dissolve into each other with relative case. The H-bonding in $C_2H_5OH$ or $H_2O$ is relatively strong and non-polar molecules cannot overcome them. Thus 'like dissolves like' is applied here too.

**53.** Ans. (1) Ni atom has the configulartion as :




$Ni(CO)_4$ has the following electronic structure:

$sp^3$ hybridisation

Thus $Ni(CO)_4$ complex is tetrahedral with no unpaired electrons. The oxidation number of Ni in this compound is zero.

54. Ans. (3) Chlorine bleaches by oxidation while $SO_2$ by reduction.

The product bleached by $SO_2$ will be further oxidised by air and will come in its original colour. Hence, bleaching by $SO_2$ is temporary.

55. Ans. (1) Alkyl free radical is stabilised by resonance as :

$$CH_2{=}CH{-}CH_2\cdot \rightleftarrows \cdot CH_2{-}CH{=}CH_2$$

where such resonance stabilisation is not possible in the case of simple alkyl radicals.

56. Ans. (3) Acetylation reduces the basic character of amino group of aniline. Hence, electron density on benzene ring will be reduced as a result of acetylation.

57. Ans. (3) $SnCl_2$ is a strong reducing agent and it reduces $HgCl_2$ to grey mass of metallic mercury

$$2HgCl_2 + SnCl_2 \rightarrow Hg_2Cl_2 + SnCl_4$$
$$Hg_2Cl_2 + SnCl_2 \rightarrow 2Hg + SnCl_4$$

58. Ans. (1) $Z_{eff}$ felt by 3d

$$= 25 - (0.35 \times 4 + 1.0 \times 18) = 5.60$$

$Z_{eff.}$ felt by 4s

$$= 25 - (1 \times 0.35 + 13 \times 0.85 + 1.0 \times 10) = 3.60$$

Evidently attraction between nucleus and 4s electrons is less than that between 3d and nucleus. Hence removal of 4s electrons will be easier.

59. Ans. (2) $_{42}Mo^{99} \rightarrow {}_{43}Tc^{99} + {}_{-1}e^{0}$

$$\downarrow$$

$${}_{43}Tc^{99} + \gamma$$

60. Ans. (3) The exponents 'x' and 'y' are experimentally determined and are not necessarily equal to coefficient 'a' and 'b' respectively. The exponents may be integers, fractions or even zero.

# AIIMS-2001. Part C. Biology

**1. The scientist who cut the tail of mouse in many generations but found that it is not inherited:**

(1) Bateson (2) Lamarck
(3) Weismann (4) Darwin

**2. Which of the following is not a pentose sugar?**

(1) Xylulose (2) Mannose
(3) Xylose (4) Arabinose

**3. Which of the following is the smallest cell?**

(1) Virus
(2) *Chlamydomonas*
(3) *Acetabularia*
(4) *Pleuropneumonia*

**4. The functional unit of Golgi apparatus is:**

(1) thylakoids (2) oxysomes
(3) cisternae (4) cristae

**5. Haploid cells can be obtained from:**

(1) Leaf (2) Anther
(3) Seed (4) Stem

**6. Lipase breaks the :**

(1) glycosidic bond (2) hydrogen bond
(3) peptide bond (4) ester bond

**7. Chemiosmotic mechanism is related with:**

(1) Glycolysis
(2) Electron transport chain
(3) Kreb's cycle (4) All of these

**8. Protozoans are considered animals because they are:**

(1) Herbivorous (2) Carnivorous
(3) Autotrophic (4) Heterotrophic

**9. Quinine, the remedy for malaria, is extracted from:**

(1) Leaves of *Ocimum*
(2) Stem of Hevea
(3) Bark of Cinnamon
(4) Bark of Cinchona

**10. Phylogenetically, the sponges have evolved from:**

(1) Choanoflagellates
(2) Phytoflagellates (3) Both
(4) None

**11. Which of the following is a worm but not flatworm?**

(1) *Echinococcus*
(2) *Enterobius* (3) *Taenia*
(4) *Dugesia*

**12. Famous Indian Zoologist who wrote a memoir upon** *Pheretima posthuma*:

(1) Beni Prasad (2) Bahl K.N.
(3) Bhatia M.L. (4) J.C. Bose

**13. A definite number of body segments is found in:**

(1) Slug (2) Leech
(3) Tapeworm (4) Earthworm

**14. Complete metamorphosis occurs in:**

(1) Silverfish (2) Bedbug
(3) Moths and mosquitoes
(4) Grasshopper

**15. Which of the following is not a class of arthropods?**

(1) Myriapoda (2) Onychophora
(3) Polychaeta (4) Insecta

**16. In which class of Echinodermata, a pluteus larva is formed?**

(1) Holothuroidea (2) Asteroidea
(3) Echinoidea (4) Crinoidea

**17. Which of the following fish is famous for migration:**

(1) Ribbonfish (2) Carp
(3) Shark (4) Salmon

**18. Milk glands are characteristic of:**

(1) Only primates and ruminants
(2) Only placental mammals
(3) All mammals (4) All vertebrates

**19. During extreme aridity, desert rat:**

(1) does not use water

(2) uses metabolic water

(3) saves water (4) stores water

**20. Identify the correctly matched pair:**

(1) Melghat- Tiger

(2) Kaziranga- Hangul

(3) Dachigam- Musk deer

(4) Velavadar- Avifauna

**21. Which cells have the shape of signet ring?**

(1) Mast cells (2) Adipocytes

(3) Melanocytes (4) Osteoblasts

**22. In albinism, the absence of the following pigment makes the skin and hair very light coloured:**

(1) haemoglobin (2) carotene

(3) melanin (4) chlorophyll

**23. Appendicular skeleton includes all except:**

(1) Pectoral and pelvic girdles

(2) Vertebrae (3) Forelimbs

(4) Hindlimbs

**24. The vertebra which bears the whole weight of the skull is:**

(1) Sacral (2) Cervical

(3) Axis (4) Atlas

**25. One of the following is an important specific functions of the liver. Mark the correct one:**

(1) Histolysis (2) Digestion

(3) Glycogenolysis (4) Excretion

**26. Large amounts of a single antibody can now be synthesised by using-**

(1) Transgenic technology

(2) Hybridoma technology

(3) Tissue culture technology

(4) Gene technology

**27. Which causes water pollution ?**

(1) Aeroplanes (2) Automobiles exhaust

(3) Smoke (4) 2, 4-D and pesticides

**28. The peristome of *Funaria* has-**

(1) 16 teeth in 2 rings

(2) 16 teeth in one ring

(3) 32 teeth in 2 rings

(4) 4 teeth in one ring

**29. Which one of the following pairs is not correctly matched ?**

(1) Myeloma – Antibody producing tumor cells

(2) Cosmid – A vector for carrying large DNA fragments into host cells

(3) Interferon – An enzyme that interferes with DNA replication

(4) Plasmid – Small piece of extrachromosomal DNA in bacteria

**30. Bar of Sanio are the -**

(1) Medullary ray cells with bar like orientation in *Ephedra*

(2) Rings around the torus of all gymnosperm wood

(3) Thickened boundaries between bordered pits of pine wood

(4) Unthickened cellulose walls between bordered pits of pine wood

**31. *If the stomata are more on the under* surface of the leaf than on upper, it comes under-**

(1) Potamoge ton type

(2) Potato type (3) Barley type

(4) Oat type

**32. *Orobanche* plant is -**

(1) Total stem parasite

(2) Symbiont (3) Total root parasite

(4) Partial parasite

**33. During adverse environmental condi tions, plants develop a stress hormone which is-**

(1) Dichloropheoxy acetic acid

(2) Benzene-amino purine

(3) Ethylene (4) Abscissic acid

**34. In any given ecosystem, number of in dividuals in a species remains more o less constant over a period of time. Thi constancy of number is maintained by -**

(1) Available food (2) Man

(3) Predators (4) Parasites

**35. Shikonin is a -**

(1) Enzyme (2) Antibiotic

(3) Dye (4) Alkaloid

**36. Pasteurised milk is-**

(1) Not free from bacteria

(2) Free from pathogenic bacteria

(3) Sterile and will not turn sour under any condition

(4) None of the above

**37. Two wings in *Pinus* seed originate from-**

(1) Cone axis (2) Bract scale

(3) Adaxial surface of ovuliferous scale

(4) Integument

**38. The Scutellum of the grass embryo is a**

(1) Vestigial organ (2) Absorptive organ

(3) Reserve food storage organ

(4) Photosynthetic organ

**39. Which one of the following is the earliest land plant ?**

(1) *Cooksonia* (2) *Cordaites*

(3) *Hornea* (4) *Rhynia*

**40. Left handed DNA is known as-**

(1) Z-DNA (2) B-DNA

(3) Both are similar (4) None of the above

**41. The source of oxygen liberated in photosynthesis is -**

(1) Carbon dioxide

(2) A photosynthetic enzyme

(3) Water

(4) Carbohydrate already present in leaf

**42. Molybdenum plays a large role in -**

(1) Carbon fixation (2) Nitrogen fixation

(3) Chromosome condensation

(4) Promoting flowering

**43. A plant that completes its life cycle before the onset of dry conditions fall into which of the following categories ?**

(1) Amphibious hydrophytes

(2) Short day plant (3) Drought escaping

(4) Mangroves

**44. Cotton is a -**

(1) Stem fibre (2) Bast fibre

(3) Hard fibre (4) Surface fibre

**45. A typical anther wall has-**

(1) Exothecium and tapetum

(2) Exothecium, endothecium and tapetum

(3) Endothecium and tapetum

(4) Exothecium and endothecium

**46. The secondary wood of *Pinus* is characterised by -**

(1) Presence of vessels

(2) Absence of resin ducts

(3) Presence of resin ducts

(4) Presence of resin canals

**47. Phytotron is a facility to -**

(1) Conserve endangered plants

(2) Micropropagate plants

(3) Grow plants under controlled conditions

(4) Grow disease free plants.

**48. The number of male prothallial cells in *Selaginella* are-**

(1) Nil (2) Four (3) Two (4) One

**49. What is the action spectrum of transpiration ?**

(1) Blue and red (2) Blue and far red

(3) Orange and red (4) Green and ultraviolet

**50. Major source of liquid hydrocarbon is -**

(1) *Solanum tuberosum*

(2) *Euphorbia antisyphilitica*

(3) *Cocos nucifera*

(4) *Calotropis gigantea*

§ ***Directions : Q.No 51 to 60 consists of two statements, one labelled the 'Assertion (1)' and the other labelled the 'Reason (R)'. Examine these statements carefully and decide if***

(1) If both assertion and reason are true statements and the reason is a correct explanation of the assertion

(2) If both assertion and reason are true statements but reason is not a correct explanation of the assertion

(3) If the assertion is true but the reason is a false statement

(4) If both assertion and reason are false statements

51. **Assertion (1) :** Each Haversian canal contains blood vessels and nerves
Reason (R) : Spongy bones have Haversian canals
(1) (2) (3) (4)

52. **Assertion (1) :** In orthotropous ovule, the micropyle, chalaza and funicle lie in single straight line
Reason (R) : The chromatin structure, in electron microscope does not resemble beads on a string.
(1) (2) (3) (4)

53. **Assertion (1) :** Every tissue and organ has its special requirements for optimal growth.
Reason (R) : auxins, gibberellins and cytokinins can not be added in the medium
(1) (2) (3) (4)

54. **Assertion (1) :** Yeasts are multicellular but most of the ascomycetes are composed of aseptate hyphae.
Reason (R) : The ascospores in ascomycetes are produced in thin walled sac-like, spore producing units called asci.
*(1)* *(2)* *(3)* *(4)*

55. **Assertion (1) :** Testosterone is produced by the testes of mature males.
Reason (R) : The production is stimulated by GH.
(1) (2) (3) (4)

56. **Assertion (1) :** DDT and aldrin are contact insecticides and their fat-solubility (often needed to penetrate waxy epicuticle) resulting in accumulation in fat reserves of animals in higher trophic levels.
Reason (R) : The mode of entry of contact insecticides to the body is via the cuticle rather than the gut.
(1) (2) (3) (4)

57. **Assertion (1) :** Preparation of recombinant DNA (r-DNA) requires restriction enzyme.
Reason (R) : Because restriction enzyme is not used to cleave plasmid DNA
(1) (2) (3) (4)

58. **Assertion (1) :** During sexual process of basidiospore formation, a basidium begins with one nucleus from each parent
Reason (R) : The basidium does not assume the shape characteristic of that species.
(1) (2) (3) (4)

59. **Assertion (1) :** *Aquaspirilla* are helical or vibroid organisms without flagella
Reason (R) : Because in this organisms growth occurs in the presence of 3% NaCl
(1) (2) (3) (4)

60. **Assertion (1) :** Tendrils of *Smilax* are homologous to leaflets
Reason (R) : The first-formed elements of phloem are called protophloem.
(1) (2) (3) (4)

## ANSWERS WITH EXPLANATIONS

1.(3) 2.(2) 3.(4) 4.(3) 5.(2) 6.(4) 7.(2) 8.(4) 9.(4) 10.(1) 11.(2) 12.(2) 13.(2) 14.(3) 15.(3) 16.(3) 17.(4) 18.(3) 19.(2) 20.(1) 21.(2) 22.(3) 23.(2) 24.(4) 25.(3) 26.(2) 27.(4) 28.(1) 29.(3) 30.(3) 31.(2) 32.(3) 33.(4) 34.(1) 35.(3) 36.(2) 37.(3) 38.(1) 39.(4) 40.(1) 41.(3) 42.(2) 43.(3) 44.(4) 45.(2) 46.(4) 47.(3) 48.(4) 49.(1) 50.(2) 51.(3) 52.(3) 53.(3) 54.(3) 55.(3) 56.(1) 57.(3) 58.(3) 59.(4) 60.(4)

1. (3) August Weismann (1885) formulated the famous 'Theory of continuity of germplasm'.
2. (2) Mannose is a hexose sugar.
3. (4) Pleuropnumonia like organisms (PPLO) discovered by Nocard and Roux (1898) consists of *Mycoplasma* and *Acholeplasma*, and measure about 0.125 to 0.150µm in diameter.
4. (3) Cisternae are found associated with both Golgi complex and endoplasmic reticulum.
5. (2) Meiosis occurs in the microspore mother cells within anther of angiosperms.
6. (4) Lipids contain ester bonds between fatty acids and glycerol.
7. (2) The chemiosmotic coupling hypothesis explaining electron transfer during phosphorylation of ADP was proposed by P. Mitchell in 1961 (Nobel Prize in 1978).
8. (4) All animals are heterotrophic.
9. (4) Quinine is a white, bitter, crystalline alkaloid extracted from the bark of cinchona, used in antimalarial medications.
10. (1) The sponges closely resemble colonial choanoflagellates belonging to the phylum Protozoa. Both possess collared and amoeboid cells.
11. *(2) Enterobius* is a nematode, not a flatworm.
12. (2) Prof. Karm Narayan Bahl of Lucknow University published a memoir on Indian earthworm Pheretima in 1926. He was awarded Joy Gobind Law Memorial Gold Medal in 1942 "for notable researches in Asiatic Zoology".
13. (2) Unlike other annelids there is a fixed number of segments (33) in a leech.
14. (3) Complete metamorphosis occurs in the insects belonging to the division Endopterygota or Holometabola.
15. (3) Polychaeta is a class of phylum Annelida.
16. (3) A pluteus larva is formed in echinoderms belonging to the classes Ophiuroidea and Echinoidea.
17. (4) Atlantic salmon and Pacific salmon are the best examples of fishes showing anadromous migration.
18. (3) Mammary glands are present in all mammals.
19. (2) Metabolic water is formed during the respiration of carbohydrates.
20. (1) Melghat National Park, Ghaurilagarh, Maharashtra is associated with the conservation of tiger.
21. (2) Owing to the presence of fat globule, the cytoplasm is pushed to periphery in adipocytes, giving it the shape of a signet ring.
22. (3) Albinism is a genetic disease; a recessive autosomal mutant gene results in the deficiency of the enzyme tyrosinase required for the production of melanin.
23. (2) Vertebral column is a part of axial skeleton.
24. (4) According to Greek mythology, Atlas is the Titan who bore the heavens on his shoulders. If the skull can be considered as the heavens, the first vertebra which bears the

whole weight of the skull can be regarded as Atlas,

25. (3) Liver is the centre of cabohydrate metabolism.

26.(2) The monoclonal antibodies, identical molecules specific for one type of antigen, are made outside the body by hybrid cell culture. The technique is known as hybridoma technology.

27.(4) The term pesticide includes insecticides, fungicides, nematicides, herbicides, weedicides, biocides. These substances are used to kill pests but being broad spectrum in action, other organisms also get affected. Pesticides also enter the body of plant and animal through water. These substances than interfere with metabolic activities of plant and animals.

28.(1) In *Funaria* peristome consists of two rings of flat curved and conical teeth called peristomial teeth. These are simply plate of cuticle and do not have cells. In each ring there are 16 teeth.

29.(3) Interferons, which were discovered for the first time in 1957 by two British scientist (Alick Isaacs and Jean Lindermann) are proteinaceous substances (mol.wt. 18000 to 100,000) produced inside the body for defence against virus infection. They are also produced in response to many non-antigenic chemicals including polysaccharides, endotoxins, double stranded DNA, RNA etc.

30.(3) Thickened boundaries between bordered pits of pine wood.

31.(2) Potato type stomata occur on both the leaf surfaces, being more on the lower surface than on the upper.

32.(3) Total parasites never poseess chlorophyll, hence, they always obtained their food from the host. They may be attached to branches, stem or roots of host plants. *Orobanche* is a total root parasite.

33.(4) During adverse condition plant develop abscissic acid. It helps in closing of stomata by causing potassium ions to leave the guard cells (Thus reducing their turgidity) during the periods of water shortage or drought and hence, is also known as Stress hormone.

34.(1) Available food.

35.(3) 'Shikonin' is an important red dye which can be obtained by tissue culture.

36.(2) The pasteurisation was developed by Louis Pasteur in 1860s. The process for milk was adopted in 1895. Primary object of this process is to eliminate disease causing bacteria from milk, though the total number of bacteria is also very much reduced during this process. It reduces the chances of milk-spoilage.

37.(3) In *Pinus* as the embryo matures a thin layer of the ovuliferous scale fuses with the testa of the seed forming wings.

38.(1) In monocotyledonous plants only one cotyledon is present. It is shield shaped and situated above the coleoptile. It is termed as scutellum which is a vestigial organ.

39.(4) *Rhynia* is considered to be the earliest land plant.

40.(1) Left handed DNA is known as Z-DNA.

41.(3) Water.

42.(2) A proper amount of minerals like molybdenum, iron and calcium in the soil is essential for nitrogen fixing microorganisms. They require molybdenum for their activity.

43.(3) Plants that completes its life cycle before dry conditions are termed as 'Drought escaping' such as *Argemone mexicana, Cassia tora, Solanum xanthocarpum* etc. Most of them are ephemeral annuals.

44.(4) Surface fibre.

45.(2) A typical anther wall has four layers : (i) Epidermis (ii) Endothecium (iii) Middle layer and (iv) Tapetum. Among given options (2) is more appropriate answer.

46.(4) In *Pinus* the resin canals are present both in primary and secondary wood. Each resin canal is surrounded by the epithelial cells, which secrete turpentine. The turpentine acts as an antiseptic in healing the wounds caused by fungi or bacteria. The turpentine is oxidized to solid resin when exposed to air. This solid resin covers the wound until new bark is replaced.

47.(3) Grow plants under controlled conditions.

48.(4) When the male gametophyte is shed from the microsporangium, it has 13 cells -4 primary androgonial cells which are located at the centre. 8 peripheral jacket cells which surround the primary androgonial cells and a prothallial cell.

49.(1) The opening of stomata in the light is most common phenomenon. Stomata begin to open shortly after exposure to light. The blue and red wavelengths of light are most effective, similar to the action spectrum of photosynthesis.

50.(2) *Euphorbia antisyphilitica.*

51. (3) Spongy bones do not have Haversian canals

52. (3) Under electron microscope, the chromatin structure resembles beads on a string. These beads are formed of octamer of histone protein and DNA base pairs

53. (3) Most of the media contain inorganic salts, vitamins and sucrose. Sometimes, for tissue culture growth regulators such as auxins, gibberellins and cytokinins may also be added to the basal medium

54. (3) Yeasts are unicellular but most of the ascomycetes are composed of septate hyphae. The cross wall have each a minute and simple pore.

55. (3) The production is stimulated by LH.

56. (1)

57. (3) Preparation of r-DNA requires restriction enzyme, which is used to cleave plasmid DNA and to cleave foreign DNA

58. (3) The basidium assumes the shape characteristic of that species and generally produces four tapering projections, the sterigmata.

59. (4) Aquaspirilla are helical or vibrioid organisms that typically possess bipolar tuffs of flagella. No growth occurs in the presence of 3% NaCl or sea water.

60. (4) The tendrils of *Smilax* are homologous to stipules. The first formed elements of phloem are called medullary rays.

## PART D. GENERAL KNOWLEDGE

**1. 'Vande Matram' national song was adopted by**

(1) 1896 session of Indian National Congress
(2) 1886 session of Indian National Congress
(3) 1889 session of Indian National Congress
(4) 1892 session of Indian National Congress

**2. "Jan Gan Man" National anthem was adopted by**

(1) Constitution sabha in 24 Jan. 1950
(2) Constitution sabha in 25 Jan. 1950
(3) Constitution sabha in 26 Jan. 1950
(4) Constitution sabha in 15 Aug. 1950

**3. 2004 Olympics will be held in**

(1) Paris (2) Athens
(3) Brussels (4) Beijing

**4. Highest peak of India**

(1) K2 (2) Kanchanjunga
(3) Mount Everest (4) Lhotse

**5. Which is not correctly matched ?**

(1) Subroto cup —Football
(2) Santosh trophy — Badminton
(3) Aga Khan cup — Hockey
(4) Durand cup —Football

**6. Which of the following is not related?**

(1) Pandit Jasraj — Vocalist
(2) Gopi Kishan — Kathak
(3) Dr Bhatnagar award— Science
(4) Dr Kasturi Rangan — Medicine

**7. In year 2000 Miss Universe was held in**

(1) London (2) Paris
(3) Nicosia (Cyprus) (4) Pretoria

**8. In year 2000 Miss World was held in**

(1) London (2) Manila
3) Caracas (4) Havana

**9. Tehalka.com inquiry is undertaken by**

(1) Retired judge of Supreme Court
(2) Retired judge of Delhi High Court
(3) Working judge of Supreme Court
(4) Combined Parliamentary Commission

**10. In pin code number, which is not correct**

(1) Total letter are always six
(2) Left three letters denote zone
(3) Right three letters denote sub-zone
(4) First letter denote state

**11. Which of the following is not official language of U.N.?**

(1) Spanish (2) French
(3) Arabian (4) German

**12. Librahan commission is related to**

(1) Babri Masjid (2) Tehalka.com
(3) Assassination of Indira Gandhi
(4) Assassination of Rajiv Gandhi

**13. Which of the following is a function of R.B.I?**

(1) To maintain external currency
(2) It is a banker of government
(3) It is a banker of various banks and financial institutes
(4) All the above

**14. The Nobel prize was given for the first time in the year**

(1) 1901 (2) 1912
(3) 1911 (4) 1910

**15. Which country is called the "Sugar Bowl of the world"?**

(1) India (2) Cuba
(3) Myanmar (4) Norway

**16. Megasthenes visited India during the reign of**

(1) Chandragupta II
(2) Chandragupta Maurya
(3) Ashoka (3) Harsha

**17. Which is not correctly matched?**

| Country | | Capital |
|---|---|---|
| (1) Ghana | — | Accra |
| (2) Lebanon | — | Beirut |
| (3) Kiribati | — | Yaren |
| (3) Croatia | — | Zagreb |

**18. The oral contraceptive "Saheli" is developed by**

(1) Central drug research institute
(2) AIIMS, New Delhi
(3) Beach Candy hospital Bombay
(4) World Health Organization

**19. Citrus fruits are considered a rich source of which of the following vitamins?**

(1) Vit. A (2) Vit. D
(3) Vit. C (4) Vit. K

**20. Which cricket player has bat at all positions?**

(1) Sanjay Manjerekar (2) Lala Amarnath
(3) Sunil Gavaskar (4) Venu Mankad

## ANSWERS

1. (1) 2.(1) 3.(2) 4.(1) 5.(2) 6.(4) 7.(3) 8.(1) 9.(1) 10.(4) 11.(4) 12.(1) 13.(4) 14.(1) 15.(2) 16.(2) 17.(3) 18.(1) 19.(3) 20.(2)

### Hints

3.(2) Athens (Greece)
4.(1) K2 (Godwin Austin)
5. (2) Santosh trophy – Football
9.(1) Retired supreme court judge – K. Venketswamy
11. (4) Total six official languages. Other three are English, Chinese & Russian
17. (3) Kiribati – Tarawa
18. (1) Central drug research institute – Lucknow