

**QUESTIONS & SOLUTIONS OF  
AIPMT 2012 (MAINS)**

**Date : 13-05-2012**

**Duration : 3 Hours**

**Max. Marks : 480**

**IMPORTANT INSTRUCTIONS**

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on **Side-1** and **Side-2** carefully with **blue/black** ball point pen only.
2. The test is of **3 hours** duration and Test Booklet contains 120 questions. Each question carries 4 marks. For each correct response, the candidate will get **4 marks**. For each incorrect response, **one mark** will be deducted from the total scores. The maximum marks are **480**.
3. Use **Blue/Black Ball Point Pen** only for writing particulars on this page/markings responses.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
5. **On completion of the test, the candidate must handover the Answer Sheet to the invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.**
6. The CODE for this Booklet is A. Make sure that the CODE printed on **Side-2** of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklets and the Answer Sheets.
7. The Candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your roll no. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
8. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.

Name of the Candidate (in Capitals): \_\_\_\_\_

Roll Number : in figures \_\_\_\_\_

Centre of Examination (in Capitals) : \_\_\_\_\_

Candidate's Signature: \_\_\_\_\_ Invigilator's Signature: \_\_\_\_\_

Fascimile signature stamp of

Centre Superintendent : \_\_\_\_\_

## PART - A (PHYSICS)

1. The dimensions of  $(\mu_0 \epsilon_0)^{-1/2}$  are :  
 (1)  $[L^{1/2}T^{-1/2}]$                       (2)  $[L^{-1}T]$                       (3)  $[LT^{-1}]$                       (4)  $[L^{1/2}T^{1/2}]$

**Ans. (3)**

**Sol.**  $(\mu_0 \epsilon_0)^{-1/2} = \frac{1}{\sqrt{\mu_0 \epsilon_0}} = C$  : speed of light

So dimension  $LT^{-1}$

2. A stone is dropped from a height  $h$ . It hits the ground with a certain momentum  $P$ . If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by :

- (1) 68%                      (2) 41%                      (3) 200%                      (4) 100%

**Ans. (2)**

**Sol.** When stone hits the ground momentum  $P = m\sqrt{2gh}$

when some stone dropped from  $2h$  (100% of initial) then momentum  $P' = m\sqrt{2g(2h)} = \sqrt{2}P$

Which is is changed by 41% of initial.

3. A car of mass  $m$  is moving on a level circular track of radius  $R$ . If  $\mu_s$  represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by :

- (1)  $\sqrt{\mu_s m R g}$                       (2)  $\sqrt{R g / \mu_s}$                       (3)  $\sqrt{m R g / \mu_s}$                       (4)  $\sqrt{\mu_s R g}$

**Ans. (4)**

**Sol.** For smooth driving maximum speed of car  $v$  then

$$\frac{mv^2}{R} = \mu_s mg$$

$$v = \sqrt{\mu_s R g}$$

4. A car of mass  $m$  starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude  $P_0$ . The instantaneous velocity of this car is proportional to :

- (1)  $t^2 P_0$                       (2)  $t^{1/2}$                       (3)  $t^{-1/2}$                       (4)  $\frac{t}{\sqrt{m}}$

**Ans. (2)**

**Sol.** Constant power of car  $P_0 = F.V. = ma.v$

$$P_0 = m \frac{dv}{dt} . v$$

$$P_0 dt = mv dv$$

$$P_0 . t = \frac{mv^2}{2}$$

$$v = \sqrt{\frac{2P_0 t}{m}}$$

$$v \propto \sqrt{t}$$

5. A circular platform is mounted on a frictionless vertical axle. Its radius  $R = 2\text{m}$  and its moment of inertia about the axle is  $200\text{ kgm}^2$ . It is initially at rest. A  $50\text{ kg}$  man stands on the edge of the platform and begins to walk along the edge at the speed of  $1\text{ms}^{-1}$  relative to the ground. Time taken by the man to complete one revolution is :

- (1)  $\pi\text{s}$                       (2)  $\frac{3\pi}{2}\text{s}$                       (3)  $2\pi\text{s}$                       (4)  $\frac{\pi}{2}\text{s}$

**Ans. (3)**

**Sol.** using angular momentum conservation

$$L_i = 0$$

$$L_f = mvR - I\omega$$

$$mvR = I\omega$$

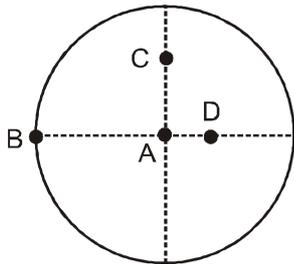
$$\omega = \left(\frac{1}{2}\right)$$

$$(v + \omega R)t = 2\pi R$$

$$\left(1 + \frac{1}{2} \times 2\right)t = 2\pi \times 2$$

$$t = 2\pi \text{ sec.}$$

6. The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through :



- (1) B                      (2) C                      (3) D                      (4) A

**Ans. (1)**

**Sol.**  $I = I_{cm} + md^2$

$d$  is maximum for point B so

$I_{max}$  about B

7. Three masses are placed on the x-axis :  $300\text{ g}$  at origin,  $500\text{g}$  at  $x = 40\text{ cm}$  and  $400\text{g}$  at  $x = 70\text{ cm}$ . The distance of the centre of mass from the origin is :

- (1)  $40\text{ cm}$                       (2)  $45\text{ cm}$                       (3)  $50\text{ cm}$                       (4)  $30\text{ cm}$

**Ans. (1)**

$$\text{Sol. } X_{cm} = \frac{300 \times (0) + 500(40) + 400 \times 70}{300 + 500 + 400}$$

$$X_{cm} = \frac{500 \times 40 + 400 \times 70}{1200}$$

$$X_{cm} = \frac{50 + 70}{3} = \frac{120}{3} = 40\text{ cm}$$

8. If  $v_e$  is escape velocity and  $v_0$  is orbital velocity of a satellite for orbit close to the earth's surface, then these are related by :

(1)  $v_0 = \sqrt{2}v_e$

(2)  $v_0 = v_e$

(3)  $v_e = \sqrt{2}v_0$

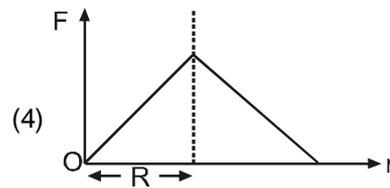
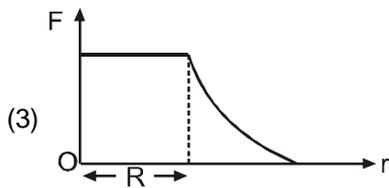
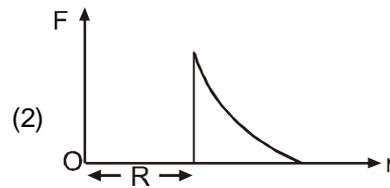
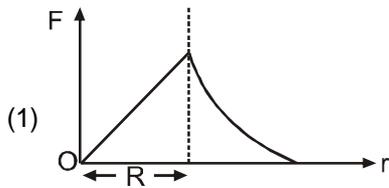
(4)  $v_e = \sqrt{2}v_0$

**Ans. (4)**

**Sol.**  $v_e = \sqrt{\frac{2GM}{R}} \Rightarrow v_0 = \sqrt{\frac{GM}{R}}$

$v_e = \sqrt{2}v_0$

9. Which one of the following plots represents the variation of gravitational field on a particle with distance  $r$  due to a thin spherical shell of radius  $R$  ? ( $r$  is measured from the centre of the spherical shell)



**Ans. (2)**

**Sol.** For  $r > R$

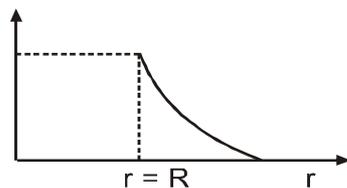
$F = \frac{GM}{r^2}$

For  $r = R$

$F = \frac{GM}{R^2}$

For  $r < R$

$F = 0$



10. A slab of stone of area  $0.36 \text{ m}^2$  and thickness  $0.1 \text{ m}$  is exposed on the lower surface to steam at  $100^\circ\text{C}$ . A block of ice at  $0^\circ\text{C}$  rests on the upper surface of the slab. In one hour  $4.8 \text{ kg}$  of ice is melted. The thermal conductivity of slab is :

(Given latent heat of fusion of ice =  $3.36 \times 10^5 \text{ J kg}^{-1}$ ) :

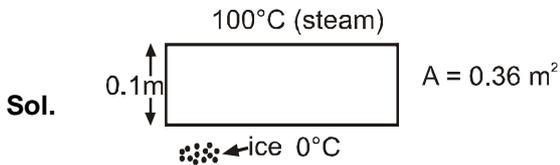
(1)  $1.24 \text{ J/m/s}^\circ\text{C}$

(2)  $1.29 \text{ J/m/s}^\circ\text{C}$

(3)  $2.05 \text{ J/m/s}^\circ\text{C}$

(4)  $1.02 \text{ J/m/s}^\circ\text{C}$

**Ans. (1)**



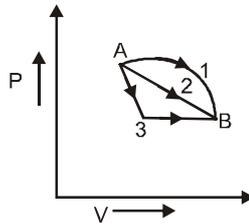
Rate of heat given by steam = Rate of heat taken by ice

$$\frac{dQ}{dt} = \frac{KA(100 - 0)}{\ell} = m \frac{dL}{dt}$$

$$\frac{K \times 100 \times 0.36}{0.1} = \frac{4.8 \times 3.36 \times 10^5}{60 \times 60}$$

$$K = 1.24 \text{ J/m/s/}^\circ\text{C}$$

11. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram :



If  $Q_1, Q_2, Q_3$  indicate the heat absorbed by the gas along the three processes and  $\Delta U_1, \Delta U_2, \Delta U_3$  indicate the change in internal energy along the three processes respectively, then

- (1)  $Q_1 > Q_2 > Q_3$  and  $\Delta U_1 = \Delta U_2 = \Delta U_3$   
 (2)  $Q_3 > Q_2 > Q_1$  and  $\Delta U_1 = \Delta U_2 = \Delta U_3$   
 (3)  $Q_1 = Q_2 = Q_3$  and  $\Delta U_1 > \Delta U_2 > \Delta U_3$   
 (4)  $Q_3 > Q_2 > Q_1$  and  $\Delta U_1 > \Delta U_2 > \Delta U_3$

**Ans. (1)**

Sol. Initial and final condition is same for all process

$$\Delta U_1 = \Delta U_2 = \Delta U_3$$

$$\Delta Q = \Delta U + \Delta W$$

Work done  $\Delta w_1 > \Delta w_2 > \Delta w_3$  (Area of P.V. graph)

So  $\Delta Q_1 > \Delta Q_2 > \Delta Q_3$

12. The equation of a simple harmonic wave is given by

$$y = 3 \sin \frac{\pi}{2} (50t - x)$$

Where  $x$  and  $y$  are in meters and  $t$  is in seconds. The ratio of maximum particle velocity to the wave velocity is

- (1)  $2\pi$                       (2)  $\frac{3}{2}\pi$                       (3)  $3\pi$                       (4)  $\frac{2}{3}\pi$

**Ans. (2)**

**Sol.**  $y = 3\sin\frac{\pi}{2}(50t - x)$

$$y = 3\sin\left(25\pi t - \frac{\pi}{2}x\right)$$

Wave velocity  $v = \frac{\omega}{k} = \frac{25\pi}{\pi/2} = 50 \text{ m/sec.}$

$$v_p = \frac{\partial y}{\partial t} = 75\pi \cos\left(25\pi t - \frac{\pi}{2}x\right)$$

$$v_{p \text{ max}} = 75\pi$$

then  $\frac{v_{p \text{ max}}}{v} = \frac{75\pi}{50} = \frac{3\pi}{2}$

- 13.** A train moving at a speed of  $220\text{ms}^{-1}$  towards a stationary object, emits a sound of frequency  $1000 \text{ Hz}$  . Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the of the train is :

(speed of sound in air is  $330 \text{ ms}^{-1}$ )

- (1)  $3500 \text{ Hz}$                       (2)  $4000 \text{ Hz}$                       (3)  $5000 \text{ Hz}$                       (4)  $3000 \text{ Hz}$

**Ans. (3)**

- Sol.** Frequency of the echo detected by the driver of the train is

$$f' = \left(\frac{v+u}{v-u}\right) f$$

$$f' = \left(\frac{330+220}{330-220}\right) 1000$$

$$= 5000 \text{ Hz}$$

- 14.** A parallel plate capacitor has a uniform electric field  $E$  in the space between the plates. If the distance between the plates is  $d$  and area of each plate is  $A$ , the energy stored in the capacitor is :

- (1)  $\frac{1}{2}\epsilon_0 E^2$                       (2)  $E^2 Ad/\epsilon_0$                       (3)  $\frac{1}{2}\epsilon_0 E^2 Ad$                       (4)  $\epsilon_0 EAd$

**Ans. (3)**

**Sol.**  $U = \frac{1}{2}CV^2$

$$V = E.d.$$

$$C = \frac{A\epsilon_0}{d}$$

$$U = \frac{1}{2} \frac{A\epsilon_0}{d} (Ed)^2$$

$$= \frac{1}{2} \frac{A\epsilon_0 E^2 d}{d}$$

15. Two metallic spheres of radii 1 cm and 3 cm are given charges of  $-1 \times 10^{-2}$  C and  $5 \times 10^{-2}$  C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is :  
 (1)  $2 \times 10^{-2}$  C                      (2)  $3 \times 10^{-2}$  C                      (3)  $4 \times 10^{-2}$  C                      (4)  $1 \times 10^{-2}$  C

**Ans. (2)**

- Sol.** At equilibrium potential of both sphere becomes same if charge of sphere one x and other sphere Q – x then where  $Q = 4 \times 10^{-2}$  C

$$\frac{kx}{1 \text{ cm}} = \frac{k(Q-x)}{3 \text{ cm}}$$

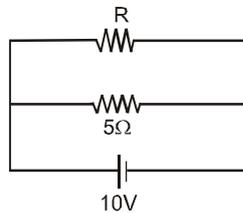
$$3x = Q - x$$

$$4x = Q$$

$$x = \frac{Q}{4} = \frac{4 \times 10^{-2}}{4} \text{ C} = 1 \times 10^{-2}$$

$$Q' = Q - x = 3 \times 10^{-2} \text{ C}$$

16. The power dissipated in the circuit shown in the figure is 30 Watts. The value of R is :



(1)  $20 \Omega$

(2)  $15 \Omega$

(3)  $10 \Omega$

(4)  $30 \Omega$

**Ans. (3)**

**Sol.**  $P = \frac{v^2}{R_{eq}}$

$$v = 10 \text{ volt}$$

$$R_{eq} = \left( \frac{5R}{5+R} \right)$$

$$P = 30 \text{ W}$$

$$30 = \frac{(10)^2}{\left( \frac{5R}{5+R} \right)}$$

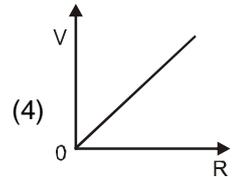
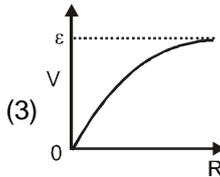
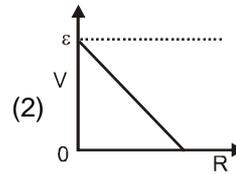
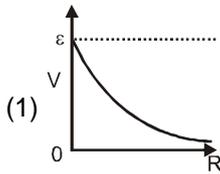
$$\frac{15R}{5+R} = 10$$

$$15R = 50 + 10R$$

$$5R = 50$$

$$R = 10 \Omega$$

17. Cell having an emf  $\epsilon$  and internal resistance  $r$  is connected across a variable external resistance  $R$ . As the resistance  $R$  is increased, the plot of potential difference  $V$  across  $R$  is given by :



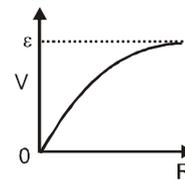
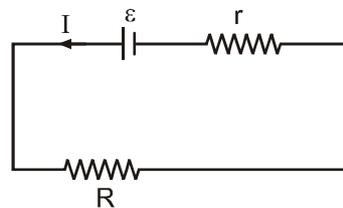
Ans. (3)

Sol.  $I = \left( \frac{\epsilon}{R+r} \right)$

$$V = IR = \left( \frac{\epsilon}{R+r} \right) R$$

$$V = \frac{\epsilon}{\left( 1 + \frac{r}{R} \right)}$$

when  $R = 0, V = 0,$   
 $R = \infty, V = \epsilon$



18. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius  $R$  in uniform magnetic field. What should be the energy of an  $\alpha$  - particle to describe a circle of same radius in the same field ?  
 (1) 2 MeV                      (2) 1 MeV                      (3) 0.5 MeV                      (4) 4 MeV

Ans. (2)

Sol.  $R = \frac{\sqrt{2mK}}{qB}$

$$q_\alpha = 2q, m_\alpha = 4m$$

$$R_\alpha = \frac{\sqrt{2(4m)K'}}{2qB}$$

$$\frac{R}{R_\alpha} = \sqrt{\frac{K}{K'}} \quad \text{but } R = R_\alpha$$

then  $K = K' = 1 \text{ MeV}$

19. A magnetic needle suspended parallel to a magnetic field requires  $\sqrt{3}$  J of work to turn it through  $60^\circ$ . The torque needed to maintain the needle in this position will be :

- (1)  $2\sqrt{3}$ J                      (2) 3J                      (3)  $\sqrt{3}$ J                      (4)  $\frac{3}{2}$ J

**Ans. (2)**

**Sol.**  $W = U_{\text{final}} - U_{\text{initial}} = MB (\cos 0 - \cos 60^\circ)$

$$W = \frac{MB}{2} = \sqrt{3}J \quad \dots (i)$$

$$\tau = \vec{M} \times \vec{B} = MB \sin 60^\circ = \left( \frac{MB\sqrt{3}}{2} \right) \quad \dots (ii)$$

From eq. (i) and (ii)

$$\tau = \frac{2\sqrt{3} \times \sqrt{3}}{2} = 3J$$

20. The instantaneous values of alternating current and voltages in a circuit are given as

$$i = \frac{1}{\sqrt{2}} \sin(100\pi t) \text{ amper}$$

$$e = \frac{1}{\sqrt{2}} \sin(100\pi t + \pi/3) \text{ Volt}$$

The average power in Watts consumed in the circuit is :

- (1)  $\frac{1}{4}$                       (2)  $\frac{\sqrt{3}}{4}$                       (3)  $\frac{1}{2}$                       (4)  $\frac{1}{8}$

**Ans. (4)**

**Sol.**  $\langle P \rangle = V_{\text{Rms}} \cdot I_{\text{Rms}} \cos \phi$

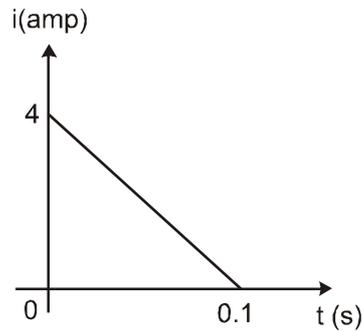
$$V_{\text{Rms}} = \frac{1}{\sqrt{2}} = \frac{1}{2} \text{ volt}$$

$$I_{\text{Rms}} = \frac{1}{\sqrt{2}} = \left( \frac{1}{2} \right) \text{ A}$$

$$\cos \phi = \cos \frac{\pi}{3} = \frac{1}{2}$$

$$\langle P \rangle = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8} \text{ W}$$

21. In a coil of resistance  $10\ \Omega$ , the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is :



- (1) 8                                      (2) 2                                      (3) 6                                      (4) 4

**Ans. (2)**

**Sol.** Area of  $i - t$  graph =  $q = \frac{1}{2} \times 0.1 \times 4$

$$q = 0.2\ \text{C}$$

$$q = \frac{\Delta\phi}{R}$$

$$q = 0.2 = \frac{\Delta\phi}{10}$$

$$\Delta\phi = 2\ \text{weber}$$

22. The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to :

- (1) the speed of light in vacuum  
 (2) reciprocal of speed of light in vacuum  
 (3) the ratio of magnetic permeability to the electric susceptibility of vacuum  
 (4) unity

**Ans. (2)**

**Sol.**  $U = \frac{1}{2} \epsilon_0 E^2 = \frac{1}{2} \frac{B^2}{\mu_0}$

$$\epsilon_0 \mu_0 = \frac{B^2}{E^2}$$

$$\frac{B}{E} = \sqrt{\epsilon_0 \mu_0} = \frac{1}{C}$$

23. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index :

(1) lies between  $\sqrt{2}$  and 1

(2) lies between 2 and  $\sqrt{2}$

(3) is less than 1

(4) is greater than 2

**Ans (2)**

**Sol.**

$$\delta_{\min} = i + e - A$$

$$\delta_{\min} = A \text{ then}$$

$$2A = i + e \quad \text{in case of } \delta_{\min} \quad i = e$$

$$2A = 2i \quad r_1 = r_2 = \frac{A}{2}$$

$$i = A = 90^\circ$$

$$\text{then } 1 \sin i = n \sin r_1$$

$$\sin A = n \sin \frac{A}{2}$$

$$2 \sin \frac{A}{2} \cos \frac{A}{2} = n \sin \frac{A}{2}$$

$$2 \cos \frac{A}{2} = n$$

$$\text{when } A = 90^\circ = i_{\min}$$

$$\text{then } n_{\min} = \sqrt{2}$$

$$i = A = 0 \quad n_{\max} = 2$$

24. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is :

(1) 10 cm

(2) 15 cm

(3) 2.5 cm

(4) 5 cm

**Ans. (4)**

**Sol.**

$$\text{When } u_1 = -20 \text{ cm}$$

$$\frac{1}{v_1} + \frac{1}{20} = \frac{1}{10}$$

$$\frac{1}{v_1} + \frac{1}{10} = \frac{1}{20} = \frac{1}{20}$$

$$v_1 = 20 \text{ cm}$$

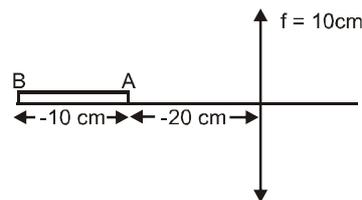
$$\text{When } u_2 = -30 \text{ cm}$$

$$\frac{1}{v_2} + \frac{1}{30} = \frac{1}{10}$$

$$\frac{1}{v_2} = \frac{1}{10} - \frac{1}{30} = \frac{1}{15}$$

$$v_2 = 15 \text{ cm}$$

$$L = v_1 - v_2 = 5 \text{ cm}$$



25. If the momentum of electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be :

(1) 200 P                      (2) 400 P                      (3)  $\frac{P}{200}$                       (4) 100 P

**Ans. (1)**

**Sol.**  $\lambda = \frac{h}{P}$

$$\frac{d\lambda}{\lambda} = -\frac{dp}{P}$$

$$\frac{0.5}{100} = \frac{P}{P'}$$

$$P' = 200P$$

26. Two radiations of photons energies 1 eV and 2.5 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximum speeds of the emitted electrons is :

(1) 1 : 4                      (2) 1 : 2                      (3) 1 : 1                      (4) 1 : 5

**Ans. (2)**

**Sol.**  $K.E_{\max} = E - W$

$$\frac{1}{2}mv_1^2 = (1 - 0.5) \text{ eV} = 0.5 \text{ eV}$$

$$\frac{1}{2}mv_2^2 = (2.5 - 0.5) \text{ eV} = 2 \text{ eV}$$

$$\frac{v_1}{v_2} = \sqrt{\frac{0.5}{2}} = \frac{1}{\sqrt{4}} = \frac{1}{2}$$

27. The transition from the state  $n = 3$  to  $n = 1$  in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from :

(1)  $2 \rightarrow 1$                       (2)  $3 \rightarrow 2$                       (3)  $4 \rightarrow 2$                       (4)  $4 \rightarrow 3$

**Ans. (4)**

28. The half life of a radioactive nucleus is 50 days. The time interval  $(t_2 - t_1)$  between the time  $t_2$  when  $\frac{2}{3}$  of it has

decayed and the time  $t_1$  when  $\frac{1}{3}$  of it had decayed is :

(1) 30 days                      (2) 50 days                      (3) 60 days                      (4) 15 days

**Ans.(2)**

**Sol.**  $N_1 = N_0 e^{-\lambda t}$                        $N_1 = \frac{1}{3} N_0$

$$\frac{N_0}{3} = N_0 e^{-\lambda t_2} \quad \dots\dots\dots(i)$$

$$N_2 = \frac{2}{3} N_0$$

$$\frac{2}{3} N_0 = N_0 e^{-\lambda t_1} \quad \dots\dots\dots(ii)$$

From eq. (i) and (ii)

$$\frac{1}{2} = e^{-\lambda(t_2-t_1)}$$

$$\lambda (t_2 - t_1) = \ln 2$$

$$t_2 - t_1 = \frac{\ln 2}{\lambda} = T_{1/2} = 50 \text{ days}$$

**29.** The input resistance of a silicon transistor is 100 W. Base current is changed by 40 μA which results in a change in collector current by 2mA. This transistor is used as a common emitter amplifier with a load resistance of 4 KΩ. The voltage gain of the amplifier is :

- (1) 2000                      (2) 3000                      (3) 4000                      (4) 1000

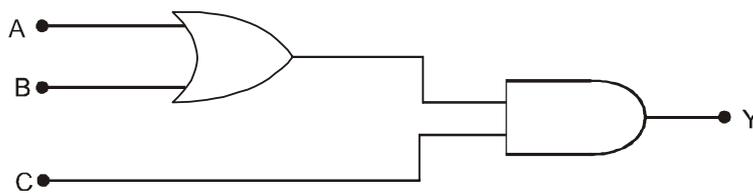
**Ans. (1)**

**Sol.** Voltage gain =  $\frac{V_{out}}{V_{in}} = \frac{I_{out}}{I_{in}} \times \frac{R_{out}}{R_{in}}$

$$= \frac{2 \times 10^{-3}}{40 \times 10^{-6}} \times \frac{4 \times 10^3}{100}$$

$$= 2 \times 1000 = 2000$$

**30.** To get an output Y = 1 in given circuit which of the following input will be correct :



	A	B	C
(1)	1	0	0
(2)	1	0	1
(3)	1	1	0
(4)	0	1	0

**Ans. (2)**

**Sol.** when A = 1,    B = 0,    C = 1    then    Y = 1

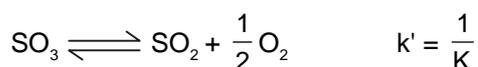
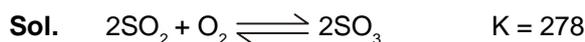
## PART - B (CHEMISTRY)

31. Given that the equilibrium constant for the reaction  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$  has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature ?



- (1)  $1.8 \times 10^{-3}$                       (2)  $3.6 \times 10^{-3}$                       (3)  $6.0 \times 10^{-2}$                       (4)  $1.3 \times 10^{-5}$

**Ans. (3)**



$$= \sqrt{\frac{1}{278}}$$

$$= \sqrt{35.97 \times 10^{-4}}$$

$$= 6 \times 10^{-2}$$

32. Structure of a mixed oxide is cubic close - packed (c.c.p). The cubic unit cell of mixed oxide is composed of oxide ions. One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B. The formula of the oxide is :

- (1)  $\text{ABO}_2$                       (2)  $\text{A}_2\text{BO}_2$                       (3)  $\text{A}_2\text{B}_3\text{O}_4$                       (4)  $\text{AB}_2\text{O}_2$

**Ans. (4)**

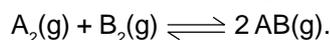
**Sol.**  $\text{A}^{2+} = \frac{1}{4} \times 8 = 2$

$$\text{B}^+ = 4 \times 1 = 4$$

$$\text{O}^{2-} = 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$$



33. Given the reaction between 2 gases represented by  $\text{A}_2$  and  $\text{B}_2$  to give the compound  $\text{AB}(\text{g})$ .



At equilibrium, the concentration

of  $\text{A}_2 = 3.0 \times 10^{-3} \text{ M}$

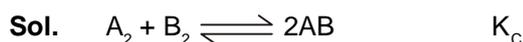
of  $\text{B}_2 = 4.2 \times 10^{-3} \text{ M}$

of  $\text{AB} = 2.8 \times 10^{-3} \text{ M}$ .

If the reaction takes place in a sealed vessel at  $527^\circ\text{C}$ , then the value of  $K_c$  will be :

- (1) 2.0                      (2) 1.9                      (3) 0.62                      (4) 4.5

**Ans. (3)**



$$K_c = \frac{(2.8 \times 10^{-3})^2}{3 \times 10^{-3} \times 4.2 \times 10^{-3}} = \frac{(2.8)^2}{3 \times 4.2} = 0.62$$

34. Activation energy ( $E_a$ ) and rate constants ( $k_1$  and  $k_2$ ) of a chemical reaction at two different temperatures ( $T_1$  and  $T_2$ ) are related by :

$$(1) \ln \frac{K_2}{K_1} = -\frac{E_a}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$(2) \ln \frac{K_2}{K_1} = -\frac{E_a}{R} \left( \frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$(3) \ln \frac{K_2}{K_1} = -\frac{E_a}{R} \left( \frac{1}{T_2} + \frac{1}{T_1} \right)$$

$$(4) \ln \frac{K_2}{K_1} = \frac{E_a}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$$

Ans. (2 or 4)

Sol.  $\ln \frac{k_2}{k_1} = \frac{E_a}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)$

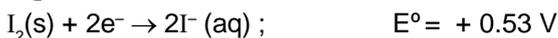
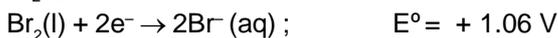
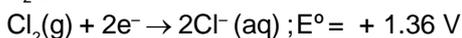
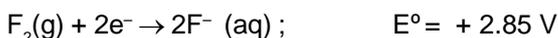
35. During change of  $O_2$  to  $O_2^-$  ion, the electron adds on which one of the following orbitals ?

- (1)  $\pi^*$  orbital                      (2)  $\pi$  orbital                      (3)  $\sigma^*$  orbital                      (4)  $\sigma$  orbital

Ans. (1)

Sol.  $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \underbrace{\pi 2p_x^2 \pi^* 2p_x^2 \pi 2p_y^2 \pi^* 2p_y^1 \sigma 2p_z^0}_{\text{For } O_2^-}$

36. Standard reduction potentials of the half reactions are given below :



The strongest oxidising and reducing agents respectively are :

- (1)  $F_2$  and  $I^-$                       (2)  $Br_2$  and  $Cl^-$                       (3)  $Cl_2$  and  $Br^-$                       (4)  $Cl_2$  and  $I_2$

Ans. (1)

Sol.  $E^\circ$  more positive, reducing agent will be greater.

37. A certain gas takes three times as long to effuse out as helium. Its molecular mass will be :

- (1) 27 u                      (2) 36 u                      (3) 64 u                      (4) 9 u

Ans. (2)

Sol.  $r \propto \sqrt{\frac{1}{M}}$

$$\frac{r_2}{r_1} = \sqrt{\frac{M_2}{M_1}}$$

$$\frac{\frac{V_g}{3t}}{\frac{V_{He}}{t}} = \sqrt{\frac{4}{M}}$$

$$\frac{1}{9} = \frac{4}{M}$$

$$M = 36 \text{ g/mole}$$

38. The orbital angular momentum of a p-electron is given as :

(1)  $\frac{h}{\sqrt{2\pi}}$

(2)  $\sqrt{3} \frac{h}{2\pi}$

(3)  $\sqrt{\frac{3}{2}} \frac{h}{\pi}$

(4)  $\sqrt{6} \cdot \frac{h}{2\pi}$

Ans. (1)

Sol. Orbital angular momentum =  $\frac{h}{2\pi} \sqrt{\ell(\ell+1)}$

$$\ell = 1$$

$$So = \frac{h}{2\pi} \sqrt{2}$$

$$= \frac{h}{\sqrt{2\pi}}$$

39. Vapour pressure of chloroform ( $\text{CHCl}_3$ ) and dichloromethane ( $\text{CH}_2\text{Cl}_2$ ) at  $25^\circ\text{C}$  are 200 mm Hg and 41.5 mm Hg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of  $\text{CHCl}_3$  and 40 g of  $\text{CH}_2\text{Cl}_2$  at the same temperature will be : (Molecular mass of  $\text{CHCl}_3 = 119.5$  u and molecular mass of  $\text{CH}_2\text{Cl}_2 = 85$  u).

(1) 173.9 mm Hg

(2) 615.0 mm Hg

(3) 347.9 mm Hg

(4) 285.5 mm Hg

Ans. Bonus

Sol.  $n_{\text{CHCl}_3} = \frac{25.5}{119.5} = 0.213$

$$n_{\text{CH}_2\text{Cl}_2} = \frac{40}{85} = 0.47$$

$$P_T = P_A X_A + P_B X_B$$

$$= 200 \times \frac{0.213}{0.683} + 41.5 \times \frac{0.47}{8.683}$$

$$= 62.37 + 28.55$$

$$= 90.92$$

40. Molar conductivities ( $\Lambda_m^\circ$ ) at infinite dilution of NaCl, HCl and  $\text{CH}_3\text{COONa}$  are 126.4, 425.9 and 91.0  $\text{S cm}^2 \text{mol}^{-1}$  respectively.  $\Lambda_m^\circ$  for  $\text{CH}_3\text{COOH}$  will be :

(1) 425.5  $\text{S cm}^2 \text{mol}^{-1}$

(2) 180.5  $\text{S cm}^2 \text{mol}^{-1}$

(3) 290.8  $\text{S cm}^2 \text{mol}^{-1}$

(4) 390.5  $\text{S cm}^2 \text{mol}^{-1}$

Ans. (4)

Sol.  $\lambda_M^\circ = \lambda_{\text{CH}_3\text{COONa}}^\circ + \lambda_{\text{HCl}}^\circ - \lambda_{\text{NaCl}}^\circ$

$$= 91 + 425.9 - 126.4$$

$$= 390.5$$

41. For real gases van der Waals equation is written as

$$\left( p + \frac{an^2}{V^2} \right) (V - nb) = nRT$$

where 'a' and 'b' are van der Waals constants.

Two sets of gases are :

(I) O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub> and He                      (II) CH<sub>4</sub>, O<sub>2</sub> and H<sub>2</sub>

The gases given in set-I in increasing order of 'b' and gases given in set-II in decreasing order of 'a', are arranged below. Select the correct order from the following :

(1) (I) He < H<sub>2</sub> < CO<sub>2</sub> < O<sub>2</sub> (II) CH<sub>4</sub> > H<sub>2</sub> > O<sub>2</sub>

(2) (I) O<sub>2</sub> < He < H<sub>2</sub> < CO<sub>2</sub> (II) H<sub>2</sub> > O<sub>2</sub> > CH<sub>4</sub>

(3) (I) H<sub>2</sub> < He < O<sub>2</sub> < CO<sub>2</sub> (II) CH<sub>4</sub> > O<sub>2</sub> > H<sub>2</sub>

(4) (I) H<sub>2</sub> < O<sub>2</sub> < He < CO<sub>2</sub> (II) O<sub>2</sub> > CH<sub>4</sub> > H<sub>2</sub>

Ans. (4)

Sol. Molar mass ↑, 'a' increases  
size of molecule ↑, 'b' increase

	b (L/mol)		a (bar.L <sup>2</sup> /mol <sup>2</sup> )
H <sub>2</sub>	→ 0.02661	CH <sub>4</sub>	→ 2.283
He	→ 0.0237	O <sub>2</sub>	→ 1.378
O <sub>2</sub>	→ 0.03183	H <sub>2</sub>	→ 0.2476
CO <sub>2</sub>	→ 0.04267		

42. Equal volumes of two monoatomic gases, A and B, at same temperature and pressure are mixed. The ratio of specific heats (C<sub>p</sub>/C<sub>v</sub>) of the mixture will be :

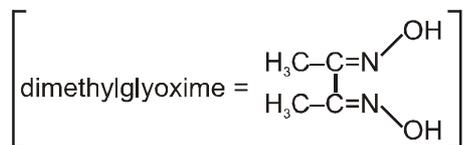
(1) 0.83                      (2) 1.50                      (3) 3.3                      (4) 1.67

Ans. (4)

Sol.  $\frac{C_p}{C_v} = \frac{\frac{5}{2}R}{\frac{3}{2}R} = \frac{5}{3} = 1.67$

43. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal Ni(II). Which of the following statements is not true ?

- (1) Red complex has a square planar geometry.
- (2) Complex has symmetrical H-bonding
- (3) Red complex has a tetrahedral geometry.
- (4) Dimethylglyoxime functions as bidentate ligand.



Ans. (3)

Sol. NiCl<sub>2</sub> + DMG → [Ni(dmg)<sub>2</sub>] ; It is not tetrahedral square planar

44. Low spin complex of  $d^6$ -cation in an octahedral field will have the following energy :

(1)  $-\frac{12}{5}\Delta_0 + P$  (2)  $-\frac{12}{5}\Delta_0 + 3P$

(3)  $-\frac{2}{5}\Delta_0 + 2P$  (4)  $-\frac{2}{5}\Delta_0 + P$

( $\Delta_0$  = Crystal Field Splitting Energy in an octahedral field, P = Electron pairing energy)

Ans. (2)

Sol.  $d^6 - t_{2g}^{2,2,2} e_g^{0,0}$  (in low spin)  
 C.F.S.E. =  $-0.4 \times 6 \Delta_0 + 3P$   
 =  $-\frac{12}{5} \Delta_0 + 3P$

45. Which one of the following does not correctly represent the correct order of the property indicated against it?

(1) Ti < V < Cr < Mn : increasing number of oxidation states

(2)  $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$  : increasing magnetic moment

(3) Ti < V < Cr < Mn : increasing melting points

(4) Ti < V < Mn < Cr : increasing 2<sup>nd</sup> ionization enthalpy

Ans. (3)

Sol. Melting point of Mn and Zn has low M.P. than their adjacent element due to stable configuration.

46. Four successive members of the first series of the transition metals are listed below. For which one of them

the standard potential ( $E_{M^{2+}/M}^0$ ) value has a positive sign ?

(1) Co (Z = 27)

(2) Ni (Z = 28)

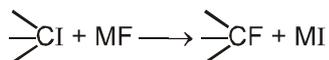
(3) Cu (Z = 29)

(4) Fe (Z = 26)

Ans. (3)

Sol.  $E_{Cu^{2+}/Cu}^0 = 0.34$  volt, other has -ve  $E_{R.P.}^0$ .

47. In the replacement reaction



The reaction will be most favourable if M happens to be :

(1) Na

(2) K

(3) Rb

(4) Li

Ans. (3)

Sol. Tertiary halide can show ionic reaction with MF so, MF should be most ionic for reaction to proceed forward. Hence 'M' should be 'Rb'.

48. In which of the following arrangements the given sequence is not strictly according to the property indicated against it ?

(1) HF < HCl < HBr < HI : increasing acidic strength

(2)  $H_2O < H_2S < H_2Se < H_2Te$  : increasing  $pK_a$  values

(3)  $NH_3 < PH_3 < AsH_3 < SbH_3$  : increasing acidic character

(4)  $CO_2 < SiO_2 < SnO_2 < PbO_2$  : increasing oxidising power

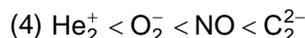
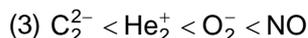
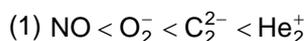
Ans. (2)

Sol. If acidic nature is high,  $K_a$  is high and  $pK_a$  is low

$H_2O < H_2S < H_2Se < H_2Te$  Acidic nature (Order of  $K_a$ )

$H_2O > H_2S > H_2Se > H_2Te$  Order of  $pK_a$

49. Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them:



Ans. (4)

Sol.  $\text{He}_2^+$  B.O. = 0.5

$\text{O}_2^-$  B.O. = 1.5

NO B.O. = 2.5

$\text{C}_2^{2-}$  B.O. = 3.0

50. The catalytic activity of transition metals and their compounds is ascribed mainly to :

(1) their magnetic behaviour

(2) their unfilled d-orbitals

(3) their ability to adopt variable oxidation state

(4) their chemical reactivity

Ans. (3)

Sol. Has variable oxidation state

e.g.  $\text{V}_2\text{O}_5$  catalyst in contact process.

51. Which of the following exhibit only +3 oxidation state ?

(1) U

(2) Th

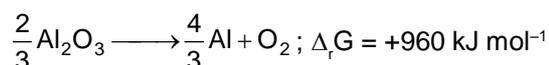
(3) Ac

(4) Pa

Ans. (3)

Sol. Only Ac form  $\text{Ac}^{+3}$

52. The Gibbs' energy for the decomposition of  $\text{Al}_2\text{O}_3$  at  $500^\circ\text{C}$  is as follows :



The potential difference needed for the electrolytic reduction of aluminium oxide ( $\text{Al}_2\text{O}_3$ ) at  $500^\circ\text{C}$  is at least :

(1) 4.5 V

(2) 3.0 V

(3) 2.5 V

(4) 5.0 V

Ans. (3)

Sol.  $\Delta G = -nFE^\circ$      $n = \frac{2}{3} \times 2 \times 3$

$960 \times 10^3 = -4 \times 96.500 \times E^\circ = 4$  for reaction

$E^\circ = -2.5$  volt

So, it needed 2.5 volt for reduction

53. Chloroamphenicol is an :

(1) antifertility drug

(2) antihistaminic

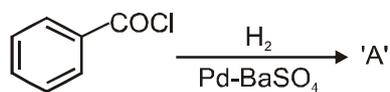
(3) antiseptic and disinfectant

(4) antibiotic-broad spectrum

Ans. (4)

Sol. Chloroamphenicol is a broad spectrum antibiotic.

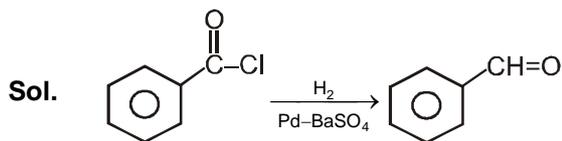
54. Consider the following reaction :



The product 'A' is :

- (1)  $\text{C}_6\text{H}_5\text{CHO}$                       (2)  $\text{C}_6\text{H}_5\text{OH}$                       (3)  $\text{C}_6\text{H}_5\text{COCH}_3$                       (4)  $\text{C}_6\text{H}_5\text{Cl}$

Ans. (1)



It is Rosenmund reaction.

55. Which one of the following sets forms the biodegradable polymer?

- (1)  $\text{CH}_2=\text{CH}-\text{CN}$  and  $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$   
 (2)  $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$  and  $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$   
 (3)  $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$  and  $\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH}$   
 (4)  $\text{C}_6\text{H}_5-\text{CH}=\text{CH}_2$  and  $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$

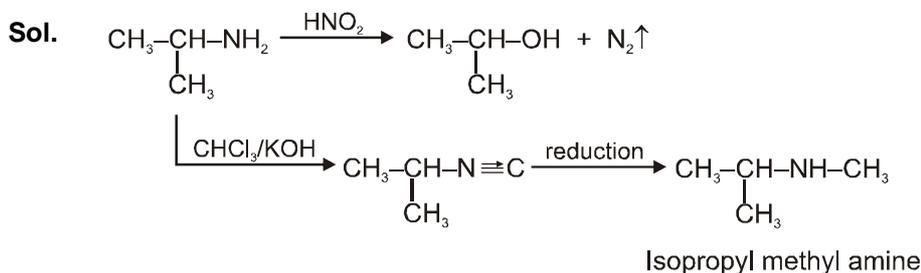
Ans. (2)

Sol. Biodegradable polymer is Nylon-2-Nylon-6 which is copolymer of glycine ( $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$ ) and amino caproic acid ( $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$ ).

56. An organic compound ( $\text{C}_3\text{H}_9\text{N}$ ) (A), when treated with nitrous acid, gave an alcohol and  $\text{N}_2$  gas was evolved. (A) on warming with  $\text{CHCl}_3$  and caustic potash gave (C) which on reduction gave isopropylmethylamine. Predict the structure of (A).

- (1)  $\begin{array}{l} \text{CH}_3 \\ \diagdown \\ \text{CH}-\text{NH}_2 \\ \diagup \\ \text{CH}_3 \end{array}$                       (2)  $\text{CH}_3\text{CH}_2-\text{NH}-\text{CH}_3$   
 (3)  $\begin{array}{c} \text{CH}_3-\text{N}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$                       (4)  $\text{CH}_3\text{CH}_2\text{CH}_2-\text{NH}_2$

Ans. (1)



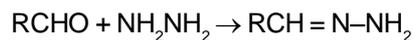
57. Which of the following reagents will be able to distinguish between 1-butyne and 2-butyne?

- (1)  $\text{NaNH}_2$                       (2)  $\text{HCl}$                       (3)  $\text{O}_2$                       (4)  $\text{Br}_2$

Ans. (1)

Sol. 1-Butyne and 2-butyne are distinguish by  $\text{NaNH}_2$  because 1-Butyne react with  $\text{NaNH}_2$  due to active hydrogen.

58. Consider the reaction :



What sort of reaction is it ?

- (1) Electrophilic addition - elimination reaction  
(2) Free radical addition - elimination reaction  
(3) Electrophilic substitution - elimination reaction  
(4) Nucleophilic addition - elimination reaction

Ans. (4)

Sol.  $\text{R}-\text{CH} = \text{O} + \text{H}_2\text{N}-\text{NH}_2 \longrightarrow \text{R}-\text{CH} = \text{N}-\text{NH}_2$

It is a Nucleophilic addition-elimination reaction.

59. Which of the following compounds will give a yellow precipitate with iodine and alkali ?

- (1) Acetophenone                      (2) Methyl acetate  
(3) Acetamide                      (4) 2-Hydroxypropane

Ans. (1, 4)

Sol. It is Iodoform reaction. Acetophenone  $\left[ \text{CH}_3-\text{C}(=\text{O})-\text{C}_6\text{H}_5 \right]$  and 2-Hydroxypropane  $\left[ \text{CH}_3-\underset{\text{OH}}{\text{CH}}-\text{CH}_3 \right]$  both give a

yellow precipitate of  $\text{CHI}_3$  (iodoform) with iodine & alkali.

60. Which of the following compounds can be used as antifreeze in automobile radiators ?

- (1) Methyl alcohol                      (2) Glycol  
(3) Nitrophenol                      (4) Ethyl alcohol

Ans. (2)

Sol. Glycol is used as an antifreeze in automobiles.

## PART - C (BIOLOGY)

61. How many organisms in the list given below are autotrophs ?  
*Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Sacharomyces, Trypanosoma, Porphyra, Wolfia*  
(1) Four (2) Five (3) Six (4) Three
- Sol.** Nostoc, chara, porphyra and wolfia are Photoautotrophs while nitrosomonas and nitrobacter are chemoautotrophs.
- Ans.** (3)
62. Read the following five statements (A - E) and answer as asked next to them.  
(A) In *Equisetum* the female gametophyte is retained on the parent sporophyte.  
(B) In *Ginkgo* male gametophyte is not independent.  
(C) The sporophyte in *Riccia* is more developed than that in *Polytrichum*.  
(D) Sexual reproduction in *Volvox* is isogamous.  
(E) The spores of slime molds lack cell walls.  
How many of the above statements are correct ?  
(1) Two (2) Three (3) Four (4) One
- Sol.** **Equisetum** - Pteridophytes - Free living gametophyte - Prothallus  
**Riccia** - It is liverwort in which simplest sporophyte consists of capsule only while polytrichum is moss in which sporophyte consists of of foot seta & capsule.  
**Volvox** - oogamy is present  
**Slime moulds** - Spores bear cell wall.
- Ans.** (4)
63. Which one of the following pairs is wrongly matched ?  
(1) Ginkgo - Archegonia  
(2) Salvinia - Prothallus  
(3) Viroids - RNA  
(4) Mustard - Synergids
- Ans.** (2)
64. In the five-kingdom classification, *Chlamydomonas* and *Chlorella* have been included in :  
(1) Protista (2) Algae (3) Plantae (4) Monera
- Sol.** *Chlamydomonas* & *Chlorella* have been mentioned in algae in kingdom protista
- Ans.** (1)
65. For its activity, carboxypeptidase requires :  
(1) Zinc (2) Iron (3) Niacin (4) Copper
- Sol.** Zinc is a cofactor for carboxypeptidases
- Ans.** (1)
66. Which one of the following structures is an organelle within an organelle ?  
(1) Ribosome (2) Peroxisome (3) ER (4) Mesosome
- Sol.** Ribosome is present in some cell organelles like mitochondria
- Ans.** (1)
67. Which one of the following is a wrong statement regarding mutations ?  
(1) Deletion and insertion of base pairs cause frame-shift mutations  
(2) Cancer cells commonly show chromosomal aberrations  
(3) UV and Gamma rays are mutagens  
(4) Change in a single base pair of DNA does not cause mutation]
- Sol.** Change in single base pair of DNA is also a type of mutations called point mutations
- Ans.** (4)
68. A test cross is carried out to :  
(1) determine the genotype of a plant at  $F_2$ .  
(2) predict whether two traits are linked.  
(3) assess the number of alleles of a gene.  
(4) determine whether two species or varieties will breed successfully.
- Sol.** Testcross - It takes place between  $F_1$  - Generation and recessive parent & it is useful to check the homozy-

- gous or heterozygous condition.
- Ans. (1)**
- 69.** Read the following four statements (A-D):  
 (A) In transcription, adenosine pairs with uracil.  
 (B) Regulation of *lac* operon by repressor is referred to as positive regulation.  
 (C) The human genome has approximately 50,000 genes.  
 (D) Haemophilia is a sex-linked recessive disease.  
 How many of the above statements are right ?  
 (1) Two (2) Three (3) Four (4) One
- Sol.** Regulation of *lac* operon by repressor is referred as negative regulation.  
 Human genome has approximately 30000 genes.
- Ans. (1)**
- 70.** Which one of the following organisms is correctly matched with its three characteristics ?  
 (1) Pea :  $C_3$  pathway, Endospermic seed, Vexillary aestivation  
 (2) Tomato : Twisted aestivation, Axile placentation, Berry  
 (3) Onion : Bulb, Imbricate aestivation, Axile placentation  
 (4) Maize :  $C_3$  pathway, Closed vascular bundles, Scutellum
- Sol.** Onion - Bulb - Underground stem - Imbricate aestivation - Axile placentation - Member of Liliaceae.
- Ans. (3)**
- 71.** How many plants in the list given below have marginal placentation ?  
 Mustard, Gram, Tulip, Asparagus, Arhar, Sun hemp, Chilli, Colchicine, Onion, Moong, Pea, Tobacco, Lupin  
 (1) Four (2) Five (3) Six (4) Three
- Sol.** Gram, Arhar, Sunhemp, Moong, Pea & Lupin belongs to Fabaceae family that bears marginal placentation.
- Ans. (3)**
- 72.** Read the following four statements (A-D):  
 (A) Both, photophosphorylation and oxidative phosphorylation involve uphill transport of protons across the membrane.  
 (B) In dicot stems, a new cambium originates from cells of pericycle at the time of secondary growth.  
 (C) Stamens in flowers of *Gloriosa* and *Petunia* are polyandrous.  
 (D) Symbiotic nitrogen-fixers occur in free-living state also in soil.  
 How many of the above statements are right ?  
 (1) Two (2) Three (3) Four (4) One
- Ans. (1)**
- 73.** Through their effect on plant growth regulators, what do the temperature and light control in the plants ?  
 (1) Apical dominance (2) Flowering (3) Closure of stomata (4) Fruit elongation
- Sol.** Flowering is induced by light temperature
- Ans. (2)**
- 74.** Which one of the following generally acts as an antagonist to gibberellins ?  
 (1) Zeatin (2) Ethylene (3) ABA (4) IAA
- Sol.** Gibberellins & ABA are antagonistic with each other.
- Ans. (3)**
- 75.** As compared to a dicot root, a monocot root has :  
 (1) More abundant secondary xylem (2) Many xylem bundles  
 (3) Inconspicuous annual rings (4) Relatively thicker periderm
- Sol.** Monocot root - Xylem is polyarch (more than 6)
- Ans. (2)**
- 76.** For its action, nitrogenase requires :  
 (1) High input of energy (2) Light  
 (3)  $Mn^{2+}$  (4) Super oxygen radicals
- Sol.** Nitrogenase require high input of energy & anaerobic condition.
- Ans. (1)**
- 77.** Vernalisation stimulates flowering in :

- Ans.** (1) Zamikand (2) Turmeric (3) Carrot (4) Ginger  
**(3)**
- 78.** What is the function of germ pore ?  
 (1) Emergence of radicle (2) Absorption of water for seed germination  
 (3) Initiation of pollen tube (4) Release of male gametes  
**Ans.** **(3)**
- 79.** Which one of the following statements is wrong ?  
 (1) When pollen is shed at two-celled stage, double fertilization does not take place.  
 (2) Vegetative cell is larger than generative cell.  
 (3) Pollen grains in some plants remain viable for months.  
 (4) Intine is made up of cellulose and - pectin.  
**Sol.** In more than 60% angiospermic plants. Pollen grains release in 2-celled stage.  
**Ans.** **(1)**
- 80.** Plants with ovaries having only one or a few ovules, are generally pollinated by :  
 (1) Bees (2) Butterflies (3) Birds (4) Wind  
**Sol.** Wind pollinated flowers have generally single ovule in each ovary.  
**Ans.** **(4)**
- 81.** Sacred groves are specially useful in :  
 (1) generating environmental awareness  
 (2) preventing soil erosion  
 (3) year-round flow of water in rivers  
 (4) conserving rare and threatened species  
**Sol.** Sacred groves are important to conserve rare and threatened species  
**Ans.** **(4)**
- 82.** The rate of formation of new organic matter by rabbit in a grassland, is called :  
 (1) Net productivity (2) Secondary productivity  
 (3) Net primary productivity (4) Gross primary productivity  
**Sol.** The productivity at consumer level is called secondary productivity & Rabbit is consumer.  
**Ans.** **(2)**
- 83.** *Cuscuta* is an example of :  
 (1) Ectoparasitism (2) Brood parasitism (3) Predation (4) Endoparasitism  
**Sol.** *Cuscuta* is found on outer side of the host and are total stem parasite.  
**Ans.** **(1)**
- 84.** The second stage of hydrosere is occupied by plants like :  
 (1) *Azolla* (2) *Typha* (3) *Salix* (4) *Vallisneria*  
**Sol.** Second stage of Hydrosere is submerged stage that is represented by *Vallisneria*.  
**Ans.** **(4)**
- 85.** Green revolution in India occurred during :  
 (1) 1960's (2) 1970's (3) 1980's (4) 1950's  
**Sol.** Green revolution in india occurred in 1960's  
**Ans.** **(1)**
- 86.** In gobar gas, the maximum amount is that of :  
 (1) Butane (2) Methane (3) Propane (4) Carbon dioxide  
**Sol.** In gobar gas the maximum amount of methane is produced by methanogenic bacteria.  
**Ans.** **(2)**
- 87.** Read the following four statements (A-D):

- (A) Colostrum is recommended for the new born because it is rich in antigens.  
 (B) Chikengunya is caused by a Gram negative bacterium.  
 (C) Tissue culture has proved useful in obtaining virus-free plants.  
 (D) Beer is manufactured by distillation of fermented grape juice.

How many of the above statements are wrong ?

- (1) Two                    (2) Three                    (3) Four                    (4) One

**Sol.** Colostrum is recommended for the new born because it is rich in antibodies.

(B) Chikengunya is caused by a virus.

**Ans.** (1)

88. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells).

- (1) both sense and anti-sense RNA                    (2) a particular hormone  
 (3) an antifeedant                    (4) a toxic protein

**Sol.** RNA interference technique, sense & Antisense RNA fused to form DS RNA that silent the expression of m-RNA of nematode.

**Ans.** (1)

89. Biolistics (gene-gun) is suitable for :

- (1) Disarming pathogen vectors  
 (2) Transformation of plant cells  
 (3) Constructing recombinant DNA by joining with vectors  
 (4) DNA finger printing

**Sol.** Biolistic - it is direct gene transferd method for constructing recombinant DNA.

**Ans.** (3)

90. In genetic engineering, the antibiotics are used :

- (1) as selectable markers                    (2) to select healthy vectors  
 (3) as sequences from where replication starts                    (4) to keep the cultures free of infection

**Ans.** (1)

91. Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them ?

- (1) *Pteropus* and *Ornithorhyncus* - Viviparity  
 (2) Garden lizard and Crocodile - Three chambered heart  
 (3) *Ascaris* and *Ancylostoma* - Metameric segmentation  
 (4) Sea horse and Flying fish - Cold blooded (poikilothermal)

**Sol.** Sea horse and flying fish are coold blooded animals.

**Ans.** (4)

92. Which one of the following categories of animals, is correctly described with no single exception in it ?

- (1) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal)  
 (2) All bony fishes have four pairs of gills and an operculum on each side.  
 (3) All sponges are marine and have collared cells.  
 (4) All mammals are viviparous and possess diaphragm for breathing

**Sol.** All sponges are marine and have collared cells without any exception.

**Ans.** (3)

93. Which one of the following organisms is scientifically correctly named, correctly printed. according to the International Rules of Nomenclature and correctly described ?

- (1) *Musca domestica* - The common house lizard, a reptile  
 (2) *Plasmodium falciparum* - A protozoan pathogen causing the most serious type of malaria  
 (3) *Felis tigris* - The Indian tiger, well protected in Gir forests.  
 (4) *E.coli* - Full name *Entamoeba coli*, a commonly occurring bacterium in human intestine

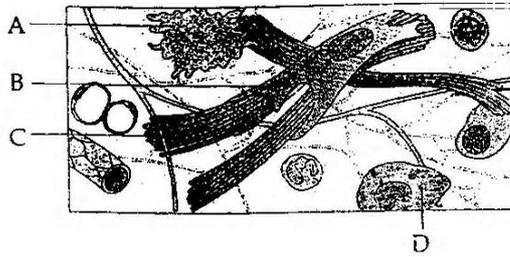
**Sol.** *Plasmodium falciparum* - A protozoan pathogen causes the most serious type of malaria that is falciparum malaria.

**Ans.** (3)

94. Which one of the following cellular parts is correctly described ?

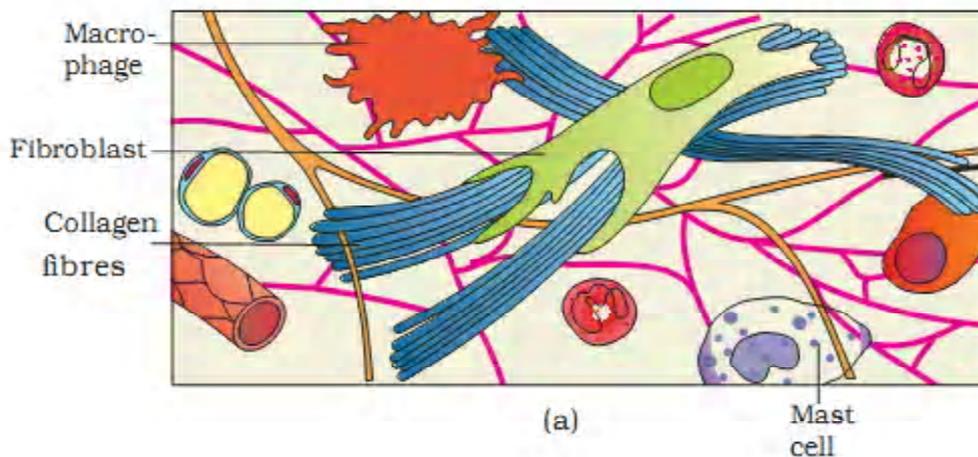


B, C and D, and select the right option about them.



	Part-A	Part-B	Part-C	Part - D
(1)	Macro-phage	Fibroblast	Collagen fibres	Mast cells
(2)	Mast cell	Macro-phage	Fibroblast	Collagen, fibres
(3)	Macro-phage	Collagen fibres	Fibroblast	Mast cell
(4)	Mast cell	Collagen fibres	Fibroblast	II Macro-phage

**Sol.** Correct labelling as follows :



**Ans. (1)**

**101.** Which one of the following options gives the correct categorisation of six animals according to the type of nitrogenous wastes (A, B, C), they give out ?

	A - AMMONOTELIC	B - UREOTELIC	C - URICOTELIC
(1)	Pigeon, Humans	Aquatic Amphibia, Lizards	Cockroach, Frog
(2)	Frog, Lizards	Aquatic Amphibia, Humans	Cockroach, Pigeon
(3)	Aquatic Amphibia	Frog, Humans	Pigeon, Lizards, Cockroach
(4)	Aquatic Amphibia	Cockroach, Humans	Frog, Pigeon, Lizards

**Sol.** Those animals who excrete Ammonia are called as Ammonotelic. Eg. Aquatic Amphibia  
 Those animals who excrete Urea are called as Ureotelic. Eg. Frog, Humans  
 Those animals who excrete Uric Acid are called as Uricotelic. Eg. Pigeon, Lizards, Cockroach

**Ans. (3)**

**102.** Where do certain symbiotic microorganisms normally occur in human body ?

- (1) Caecum (2) Oral lining and tongue surface  
 (3) Vermiform appendix and rectum (4) Duodenum

**Sol.** Caecum is small blind sac which host some symbiotic micro-organism.

**Ans.** (1)

**103.** Which one of the following pairs of, chemical substances, is correctly categorised ?

- (1) Calcitonin and thymosin - Thyroid hormones  
 (2) Pepsin and prolactin - Two digestive enzymes secreted in stomach  
 (3) Troponin and myosin - Complex proteins in striated muscles  
 (4) Secretin and rhodopsin - Polypeptide hormones

**Sol.** Troponin is a protein which is found on Actin filament and myosin protein is found in myosin filament. Both Actin and Myosin are complex proteins in striated muscles.

**Ans.** (3)

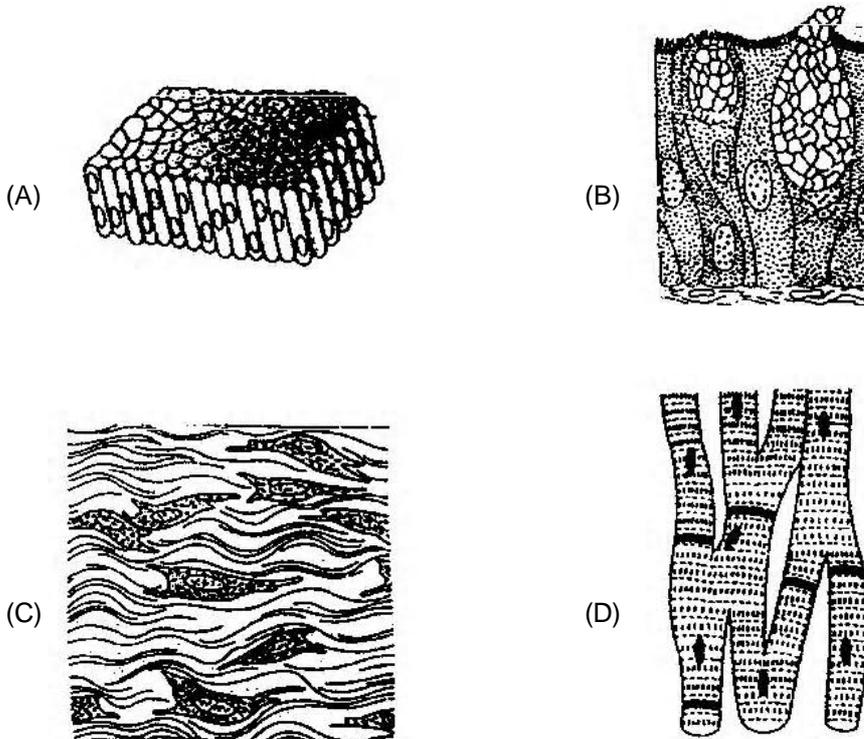
**104.** The supportive skeletal structures in the human external ears and in the nose tip are examples of :

- (1) ligament (2) areolar tissue (3) bone (4) cartilage

**Sol.** Cartilage is a type of connective tissue which is present in human external ears and in the nose tip.

**Ans.** (4)

**105.** The four sketches (A, B, C and D) given below, represent four different types of animal tissues. Which one of these is correctly identified in the options given, along with its correct location and function ?



		Tissue	Location	Function
(1)	(B)	Glandular epithelium	Intestine	Secretion
(2)	(C)	Collagen fibres	Cartilage	Attach skeletal muscles to bones
(3)	(D)	Smooth muscle tissue	Heart	Heart contraction
(4)	(A)	Columnar epithelium	Nephron	Secretion and absorption

**Sol.** The diagramme is given in Biology NCERT book class XII (page-102). Intestinal epithelium is glandular in

nature and secretory in function.

**Ans. (1)**

**106.** A fall in glomerular filtration rate (GFR) activates :

- (1) juxta glomerular cells to release renin (2) adrenal cortex to release aldosterone  
(3) adrenal medulla to release adrenaline (4) posterior pituitary to release vasopressin

**Sol.** A fall in glomerular blood flow/glomerular blood pressure/GFR can activate the JG cells to release renin which converts Angiotensinogen in blood to Angiotensin I and further angiotensin II. Angiotensin II being powerful vasoconstrictor increases the Glomerular Blood pressure and thereby GFR.

**Ans. (1)**

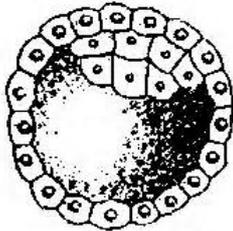
**107.** Which one of the following characteristics is common both in humans and adult frogs ?

- (1) Four - chambered heart (2) Internal fertilisation  
(3) Nucleated RBCs (4) Ureotelic mode of excretion

**Sol.** Adult frog and human exhibit ureotelism because their excretory waste product is urea.

**Ans. (4)**

**108.** Identify the human developmental stage shown below as well as the related right place of its occurrence in a normal pregnant woman, and select the right option for the two together.



**Options :**

	<b>Developmental stage</b>	<b>Site of occurrence</b>
(1)	Late morula	Middle Part of Fallopian tube
(2)	Blastula	End part of Fallopian tube
(3)	Blastocyst	Uterine wall
(4)	8 - celled morula	Starting point of Fallopian tube

**Sol.** The diagram is from Biology NCERT XII (Page - 52). Blastocyst embeds itself in endometrium of uterus and this is called Implantation.

**Ans. (3)**

**109.** Which one of the following human organs is often called the "graveyard" of RBCs ?

- (1) Gall bladder (2) Kidney (3) Spleen (4) Liver

**Sol.** Spleen is called graveyard of RBC because it removes dead RBC from the blood.

**Ans. (3)**

**110.** The secretory phase in the human menstrual cycle is also called :

- (1) luteal phase and lasts for about 6 days (2) follicular phase lasting for about 6 days  
(3) luteal phase and lasts for about 13 days (4) follicular phase and lasts for about 13 days

**Sol.** The first phase of human menstrual cycle is called Proliferative phase (Follicular phase), why Second phase of human menstrual cycle is called as secretory phase or luteal phase and it lasts for about 13 days.

**Ans. (3)**

**111.** Select the correct statement about biodiversity :

- (1) The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals.  
(2) Large scale planting of Bt cotton has no adverse effect on biodiversity.  
(3) Western Ghats have a very high degree of species richness and endemism.  
(4) Conservation of biodiversity is just a fad pursued by the developed countries.

**Sol.** Western ghat is biodiversity rich zone along with endemism.

Ans. (3)

112. The domestic sewage in large cities :
- (1) has a high BOD as it contains both aerobic and anaerobic bacteria
  - (2) is processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plants (STPs)
  - (3) When treated in STPs does not really require the aeration step as the sewage contains adequate oxygen.
  - (4) has very high amounts of suspended solids and dissolved salts

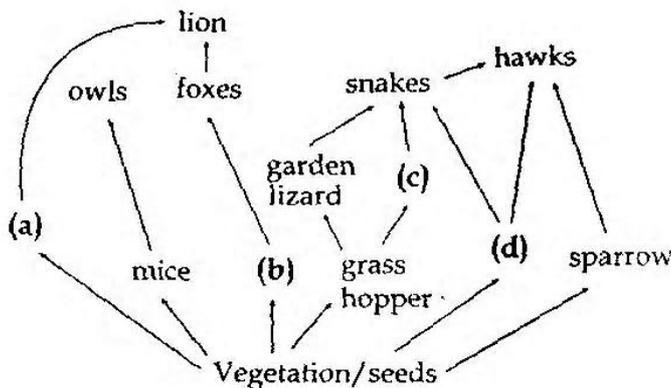
Ans. (2)

113. Which one of the following sets of items in the options 1 - 4 are correctly categorised with one exception in it ?

	ITEMS	CATEGORY	EXCEPTION
(1)	UAA, UAG, UGA	Stop codons	UAG
(2)	Kangaroo, Koala, Wombat	Australian marsupials	Wombat
(3)	Plasmodium, Cuscuta, Trypanosoma	Protozoan parasites	Cuscuta
(4)	Typhoid, Pneumonia, Diphtheria	Bacterial diseases	Diphtheria

Ans. (3)

114. Identify the likely organisms (a), (b), (c) and (d) in the food web shown below :



**Options**

	(a)	(b)	(c)	(d)
(1)	deer	rabbit	frog	rat
(2)	dog	squirrel	bat	deer
(3)	rat	dog	tortoise	crow
(4)	squirrel	cat	rat	pigeon

Ans. (1)

115. Consider the following four statements (a-d) and select the option which includes all the correct ones only.
- (a) Single cell Spirulina can produce large quantities of food rich in protein, minerals, vitamins etc.
  - (b) Body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day
  - (c) Common button mushrooms are a very rich source of vitamin C
  - (d) A rice variety has been developed which is very rich in calcium.

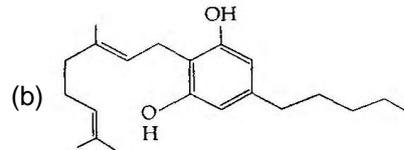
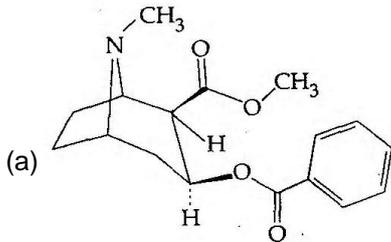
Options :

- (1) Statements (c), (d)
- (2) Statements (a), (c) and (d)
- (3) Statements (b), (c) and (d)
- (4) Statements (a), (b)

**Sol.** Spirulina is SCP rich in protein, vitamins & minerals & rice variety rich in iron content.  
250 grambiomass of Methylophilus methylotrophus produce 25 tonn protein/day while cow of 250 Kg. produces only 200 gm. protein/day.

**Ans.** (4)

**116.** Identify the molecules (a) and (b) shown below and select the right option giving their source and use.



**Options:**

	Molecule	Source	Use
(1)	(a) Cocaine	Erythroxyllum coca	Accelerates the transport of dopamine
(2)	(b) Heroin	Cannabis Sativa	Depressant and slows down body functions
(3)	(b) Cannabinoid	Atropa belladona	Produces hallucinations
(4)	(a) Morphine	Papaver somniferum	Sedative and pain killer

**Sol.** The diagramme is given on biology NCERT XII (page - 158-159). Option (a) represents morphine which is obtained from Papaver somniferum. Morphine is used as Sedative and pain killer.

**Ans.** (4)

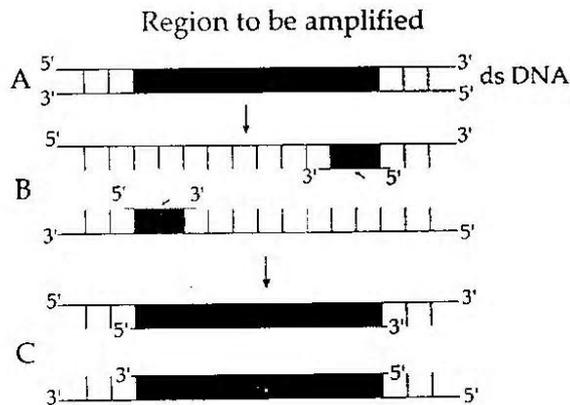
**117.** Which one of the following statements is correct with respect to immunity ?

- (1) Preformed antibodies need to be injected to treat the bite by a viper snake
- (2) The antibodies against small pox pathogen are produced by T - lymphocytes
- (3) Antibodies are protein molecules, each of which has four light chains
- (4) Rejection of a kidney graft is the function of B-lymphocytes

**Sol.** Preformed antibodies need to be injected to treat the bite by a viper snake. It is also a type of Immunisation which is called as passive immunisation.

**Ans.** (1)

118. The figure below shows three steps (A,B,C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents ?



Options :

- (1) B - Denaturation at a temperature of about 98°C separating the two DNA strands.
- (2) A - Denaturation at a temperature of about 50°C
- (3) C - Extension in the presence of heat stable DNA polymerase
- (4) A - Annealing with two sets of primers

**Sol.** Expansion proceeds at 72°C in the presence of Taq DNA polymerase in PCR

**Ans.** (3)

119. The first clinical gene therapy was given for treating :

- (1) Diabetes mellitus
- (2) Chicken pox
- (3) Rheumatoid arthritis
- (4) Adenosine deaminase deficiency

**Ans.** (4)

120. Which one of the following represents a palindromic sequence in DNA ?

- (1) 5' - GAATTC - 3'  
3' - CTTAAG - 5'
- (2) 5' - CCAATG - 3'  
3' - GAATCC - 5'
- (3) 5' - CATTAG - 3'  
3' - GATAAC - 5'
- (4) 5' - GATACC - 3'  
3' - CCTAAG - 5'

**Sol.** 5' - GAATTC - 3'

3' - CTTAAG - 5'

It is a palindromic sequence of DNA cut by restriction enzyme ECORI.

**Ans.** (1)