NEET SAMPLE PAPER – 2 (ANSWER KEY & SOLUTION)

PART – A (PHYSICS)

Answer Keys:

1. d	2. c	3. c	4. b	5. b	6. a	7. c	8. d	9. a
10. a	11. c	12. b	13. d	14. c	15. c	16. d	17. a	18. a
19. c	20. a	21. b	22. c	23. a	24. a	25. d	26. d	27. b
28. b	29. c	30. b	31. d	32. b	33. a	34. d	35.b	36. c
37. a	38. b	39. c	40. c	41. c	42. a	43. d	44. c	45. d

1. **Ans:**(d)

   Let energy, E α $P^a A^b T^c$

   Or E = k$P^a A^b T^c$

   Or $[ML^2 T^{-2}] = [ML^2 T^{-2}]^a [L^2]^b [T]^c$

   $= [M^a L^{a+2b} T^{-a+c}]$

   Hence, a = 1, b = $\frac{1}{2}$, c = −c

   Dimensional formula for E is $\left[P^1 A^{1/2} T^{-1} \right]$

2. **Ans:**(c)

   For a pendulum, T = 2π$\sqrt{\frac{l}{g}}$ where l is measured upto Centre of gravity. The centre of gravity
   of system is at Centre of sphere when hole is plugged. When unplugged, water drains out.
   Centre of gravity goes on descending. When the bob becomes empty, centre of gravity is
   restored to centre.

   ∴Length of pendulum first increases, then decreases to original value
   ∴T would first increase and then decrease to the original value

3. **Ans:**(c)

$$A = \frac{m_2 g - m_1 g \sin \theta}{m_1 + m_2} = \frac{(4g - 8g \sin 30°)}{m_1 + m_2} = 0$$

4.**Ans:**(b)

The thermal resistance of each rod is R.
In case (i) the rods are in series.

$\therefore R_s$ = R + R = 2R

Rate of flow of heat will be

$\frac{dQ}{dt} = \frac{\Delta T}{R_s}; \frac{10}{2} = \frac{(100 - 0)}{2R}$

$\therefore$ R = 10

In case (ii) the rods are parallel; so

$\frac{I}{R_p} = \frac{I}{R} + \frac{I}{R} \Longrightarrow R_p = \frac{R}{2} = 5$

Now, rate of flow of heat in this case will be

$\frac{dQ}{dt} = \frac{\Delta T}{R_p} \Longrightarrow \frac{30}{t} = \left[\frac{100 - 0}{5}\right]$
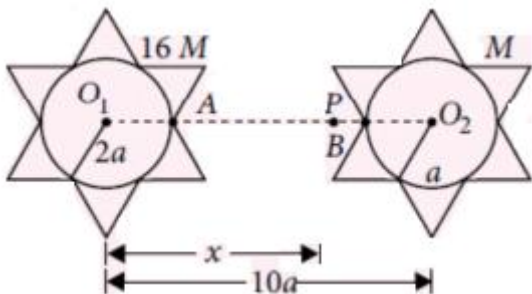
Or   t = 1.5 minute.

5.**Ans:**(b)

First we have to find a point where the resultant field due to both is zero.
Let the point P be at a distance x from centre of bigger star.

$$\Longrightarrow \frac{G(16M)}{x^2} = \frac{GM}{(10a-x)^2} \Longrightarrow x = 8a (\text{from } O_1)$$


i.e., once the body reaches P, the gravitational pull of attraction due to M takes the lead to make m move towards it automatically as the gravitational pull of attraction due to 16M vanishes i.e., a minimum KE or velocity has to be imparted to m from surface of 16M such
that it is just able to overcome the gravitational pull of 16M. By law of conservation of energy

$$\frac{1}{2}mv^2 + \left[-\frac{G(16M)m}{2a} - \frac{GMm}{8a}\right] = 0$$

$$+ \left[-\frac{GMm}{2a} - \frac{G(16M)m}{8a}\right]$$

$$\Rightarrow \tfrac{1}{2}mv^2 - \frac{GMm}{8a}\,(45) \Rightarrow v = \frac{3}{2}\sqrt{\frac{5GM}{a}}$$

6. **Ans:** (a)
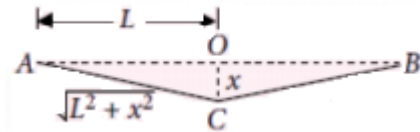
Change in length, ΔL = AC − AO

$$= [L^2 + x^2]^{1/2} - L = L\left[1 + \frac{1}{2}\frac{x^2}{L^2}\right] - L = \frac{x^2}{2L}$$

Longitudinal strain $= \frac{\Delta L}{L} = \frac{x^2/2L}{L} = \frac{x^2}{2L^2}$

7. **Ans:** (c)

Let the axis of rotation
Pass through O.
$I = mr^2$ for point mass.
∴ $I = I_1 + I_2$
$= 0.3\, x^2 + 0.7\,(1.4 - x)^2$
$= 0.3\, x^2 + 0.7\,(1.96 + x^2 - 2.8x)$
$= x^2 + 1.372 - 1.96x$
The work done for rotation of
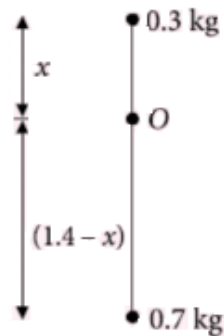The rod is stored as rotational kinetic energy,

$\frac{1}{2}I\omega^2$, of rod

Or $W = \frac{I\omega^2}{2} = \frac{1}{2}(x^2 + 1.372 - 1.96x)\,\omega^2$

For work done to be minimum, $\frac{dW}{dx} = 0$

$\therefore \frac{d}{dx}\left[(x^2 + 1.372 - 1.96x)\right]\frac{\omega^2}{2} = 0$

Or $2x + 0 - 1.96 = 0$
Or $2x = 1.96$ or $x = 0.98$ m

8. **Ans:** (d) conceptual

9. **Ans:** (a)

There is n moles of the monoatomic gas in the container.
Molar mass of the gas = m,
Total mass of the gas in the container, M = mn
Change in KE of the gas when the container is suddenly stopped, i.e.,

$\Delta K = (KE)_{initial} - (KE)_{final} = \frac{1}{2}Mv_0^2 - 0$

$= \frac{1}{2}Mv_0^2 = \frac{1}{2}mnv_0^2$

This change in kinetic energy (ΔK) result in a change in internal energy (ΔU) of the gas

$\Delta U = nC_V\Delta T = n\left(\frac{3}{2}R\right)\Delta T$

Here, ΔT is the change in temperature of the gas

As $\quad \Delta U = \Delta K, n\left(\frac{3}{2}R\right)\Delta T = \frac{1}{2}mnv_0^2$

$\therefore \quad \Delta T = \frac{mv_0^2}{3R}$

10. **Ans:**(a)

The steel wire is first stretched by an object of specific gravity ρ in air. Then the object is half submerged in water. The stretching force diminishes due to upthrust of water on the object. Let σ denote specific gravity of water. Weight of the object = Vρg

Upthrust of water on object = $\frac{V}{2}\sigma g$

$\therefore$ Tension T' = $V\rho g - \frac{V\sigma g}{2}$

or $\quad$ T' = $Vg\left(\frac{2\rho - \sigma}{2}\right)$

$\upsilon = \frac{1}{2l}\sqrt{\frac{T}{\mu}} \qquad$ where T = Vρg

$\upsilon' = \frac{1}{2l}\sqrt{\frac{T}{\mu}} \qquad \therefore \frac{\upsilon'}{\upsilon} = \sqrt{\frac{T'}{T}}$

or $\quad \frac{\upsilon'}{\upsilon} = \sqrt{\frac{Vg(2\rho - 1)}{2} \times \frac{1}{Vg\rho}}$

or $\quad \upsilon' = \upsilon\sqrt{\frac{2\rho - 1}{2\rho}}$ or $\upsilon' = 300\left[\frac{2\rho - 1}{2\rho}\right]^{1/2}$

11. **Ans:**(c)

Relative error in measurement of time,

$\frac{\Delta t}{t} = \frac{1\,s}{40\,s} = \frac{1}{40}$

Time period, T = $\frac{40s}{20}$ = 2 s

Error in measurement of time period,

$\Delta T = T \times \frac{\Delta t}{t} = 2 \text{ s} \times \frac{1}{40} = 0.05$ s

The time period of simple pendulum is

$T = 2\pi\sqrt{\frac{l}{g}}$ or $T^2 = \frac{4\pi^2 l}{g}$ or $g = \frac{4\pi^2 l}{T^2}$

$\therefore \frac{\Delta g}{g} = \frac{2\Delta T}{T} = 2 \times \frac{1}{40} = \frac{1}{20} \left(\because \ \frac{\Delta T}{T} = \frac{\Delta t}{t} \right)$

Percentage error in determination of g is

$\frac{\Delta g}{g} \times 100 = \frac{1}{20} \times 100 = 5\%$

12. **Ans:**(b)

Reynolds number,

$R_e = \frac{v\rho D}{\eta}$ and $v = \frac{4Q}{\pi D^2}$ (as $Q = \frac{\pi D^2}{4}v$),

$R_e = \frac{4Q\rho}{\pi D \eta}$

Here,
D = 1.25 cm = 1.25 × 10^{-2} m

P = 10^3 kg m^{-3}, η = 10^{-3} Pa s

Q = 5 × 10^{-5} m^3 s^{-1}

$R_e = \frac{4 \times 5 \times 10^{-5} \times 10^3}{3.14 \times 1.25 \times 10^{-2} \times 10^{-3}}$ = 5095 ≈ 5100.
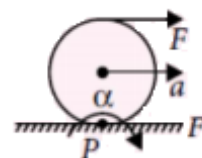
For R_e> 3000, the flow is turbulent.

13. **Ans:**(d)

Let F′ be the friction on the ring towards right, a its linear acceleration and α the angular acceleration about center of mass. Point of contact P is momentarily as rest i.e., ring will rotate about P.

$\alpha = \frac{\tau_P}{I_P} = \frac{F(2R)}{2MR^2} = \frac{F}{MR}$

now   F + F′ = Ma = MRα = F
or   F′ = 0

14. **Ans:**(c)

Efficiency of a perfect engine working between − 3° C and 27°C (i.e., T_2 = 270 K and T_1 = 300 K)

$$\eta_{engine} = 1 - \frac{T_2}{T_1} = 1 - \frac{270\ K}{300\ K} = 0.1$$

Since efficiency of the refrigerator ($\eta_{ref.}$) is 50% of η_{engine}

$$\therefore \qquad \eta_{ref.} = 0.5\ \eta_{engine} = 0.05$$

If Q_1 is the heat transferred per second at higher temperature by doing work W, then

$$\eta_{ref.} = \frac{W}{Q_1} \text{ or } Q_1 = \frac{W}{\eta_{ref.}} = \frac{1\ kJ}{0.05} = 20\ kJ$$

(as W = 1 kW × 1s = 1 kJ)

Since $\eta_{ref.}$ Is 0.05, heat removed from the refrigerator per second, i.e.,

$$Q_2 = Q_1 - \eta_{ref.}\ Q_1 = Q_1(1 - \eta_{ref.})$$

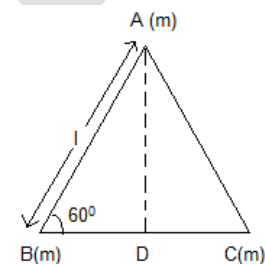$$= 20\ kJ\ (1 - 0.05) = 19\ kJ$$

15. **Ans:**(c)

Moment of inertia of each of the point masses (m) at B and C about the side BC = $m(0)^2 = 0$.

Moment of inertia of point mass m at A about the side BC = $m(AD)^2$.

Now AD = $l \sin 60° = l\frac{\sqrt{3}}{2}$

∴ Moment of inertia of the system about side BC

$$= 0 + 0 + m\left(\frac{l\sqrt{3}}{2}\right)^2 = \frac{3ml^2}{4}$$

16. **Ans:**(d)

here y = $\frac{a^4 b^2}{(cd^4)^{1/3}}$

Taking log on both sides, we get

$$\log y = 4 \log a + 2 \log b - \frac{1}{3} \log c - \frac{4}{3} \log d$$

Differentiating both sides to calculate error,

$$\frac{\Delta y}{y} \times 100 = 4\left(\frac{\Delta a}{a} \times 100\right) + 2\left(\frac{\Delta d}{d} \times 100\right)$$

$$+ \frac{1}{3}\left(\frac{\Delta c}{c} \times 100\right) + \frac{4}{3}\left(\frac{\Delta d}{d} \times 100\right)$$

$= [4 \times 2\% + 2 \times 3\% + \frac{1}{3} \times 4\% + \frac{4}{3} \times 5\%]$

$= 22\%$

17. **Ans:**(a)

Downward retardation means upward acceleration.

g' = g + a

Now t = $\sqrt{\dfrac{2L}{g' \sin \theta}}$ or t = $\sqrt{\dfrac{2L}{(g+a) \sin \theta}}$

18. **Ans:**(a)

According to Newton's law of cooling,

$\dfrac{80-64}{5}$ = k$\left[\dfrac{80+64}{2} - T\right]$ ...... (i)

and $\dfrac{80-52}{10}$ = k$\left[\dfrac{80+52}{2} - T\right]$ ...... (ii)

Where T is the temperature of the surrounding
Solving Equations (i) and (ii), we get

T = 24°C

19. **Ans:**(c)

Change in PE, $\Delta U = U_2 - U_1$

$= -\dfrac{GMm}{(R+nR)} + \dfrac{GMm}{R} = -\dfrac{GMm}{R(n+1)} + \dfrac{GMm}{R}$

$= \dfrac{(R^2 g)m}{R} \times \dfrac{n}{(n+1)} = mgR \left[\dfrac{n}{n+1}\right]$

20. **Ans:**(a)

Since there is no external force acting on the particle, hence

$y_{CM} = \dfrac{m_1 y_1 + m_2 y_2}{m_1 + m_2} = 0$

$\therefore \left(\dfrac{m}{4}\right) \times (+5) + \left(\dfrac{3m}{4}\right)(y_2) = 0$

$\Rightarrow y_2 = -5$ cm

21. **Ans:**(b)

Heat required to melt 1g of ice at 0°C to water at 0°C = 1 × 80 cal.
Heat required to raise temperature of 1 g of water from 0°C to 100°C = 1 × 1×100=100 cal
Total heat required for maximum temperature of 100°C = 80 + 100 = 180 cal

As one gram of steam gives 540 cal of heat when it is converted to water at 100^0C, therefore, temperature of the mixture would be 100^0C.

22. **Ans:**(c)

Momentum after collision = Momentum before collision

$(m_1 + m_2)v = m_1u_1 + m_2u_2$

$(0.5 + 1.0)v = 0.5 \times 2.0 + 1.0 \times 0$

$V = \dfrac{1}{1.5} = \dfrac{2}{3}$ m s^{-1}

Loss of energy,

$= \dfrac{1}{2}m_1u_1^2 - \dfrac{1}{2}(m_1 + m_2)v^2$

$= \dfrac{1}{2} \times 0.5 \times 2^2 - \dfrac{1}{2}(0.50 + 1.0)\left(\dfrac{2}{3}\right)^2$

$= 1 - \dfrac{1}{3} = 0.67\,J.$

23. **Ans:**(a)

To move straight along AB,
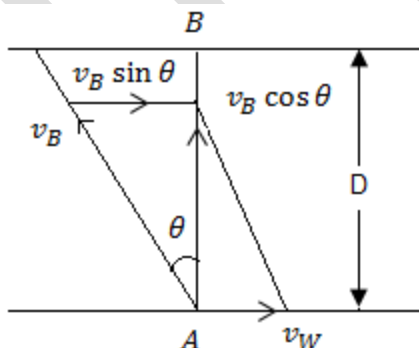
$v \sin \theta = v_W$

$\sin \theta = \dfrac{v_W}{v_B} = \dfrac{v_W}{2v_W} = \dfrac{1}{2}$

$\therefore \theta = 30^0$

Time taken to cross the river,

$t = \dfrac{D}{v_B \cos \theta} = \dfrac{D}{v_B\,30^0} = \dfrac{2D}{v_R\sqrt{3}}$

24. **Ans:**(a)

Here, u = 0, a $= \dfrac{R}{m} = \dfrac{qE}{m}$

$V = u + at = 0 + \dfrac{qE}{m}t$

$KE = \dfrac{1}{2}mv^2 = \dfrac{mq^2R^2y^2}{2m^2} = \dfrac{E^2q^2t^2}{2m}$

25. **Ans:**(d)

If d_1 is the distance of point X on axial line and d_2 is distance of point Y on equatorial line, then

$B_1 = \dfrac{\mu_0}{4\pi}\dfrac{2M}{d_1^3}, B_2 = \dfrac{\mu_0}{4\pi}\dfrac{M}{d_2^3}$

As $B_1 = B_2$

$$\therefore \frac{\mu_0}{4\pi}\frac{2M}{d_1^3} = \frac{\mu_0}{4\pi}\frac{M}{d_2^3}$$

$$d_1^3 = 2d_2^3;\ \frac{d_1}{d_2} = 2^{1/3}$$

26. **Ans:**(d)

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{25} + \frac{1}{100} = \frac{1}{100} = \frac{1}{20}$$

C_s= 20 μF = 20× 10^{-6}F

U$_1$ = $\frac{1}{2}C_S V^2 = \frac{1}{2}(20 \times 10^{-16})(120)^2 = 144 \times 10^{-3}I$

Charge on each capacitor,

q$_1$ = q$_2$ = C_s·V = 20 × 120 = 2400 μC

In parallel, $C_p = C_1 + C_2$

= 25 + 100 = 125 μF = 125 × 10^{-6}F

$\therefore$ U$_2$ = $\frac{Q^2}{2C_p} = \frac{[(2400+2400)\times10^{-6}]^2}{2\times125\times10^{-6}}$

= 92.16 × 10^{-3} J

Loss of energy = U$_1$ – U$_2$
                 = (144 – 92.16) × 10^{-3} J
                   = 51.84 × 10^{-3} J =0.052 J

27. **Ans:**(b)
Capacitor will work as open key. Therefore no current flows through resistance 4 Ω.
The total resistance of circuit

= 2.8 + $\frac{2\times3}{2+3}$ = 2.8 + 1.2 = 4Ω

$\therefore$ Main current, I = $\frac{6}{4} = \frac{3}{2}A$
Potential difference across A and B
= $\frac{3}{2} \times 1.2 = 1.8V$

$\therefore$ Current through 2Ω = $\frac{1.8}{2} = 0.9\ A$

28. **Ans:**(b)
As magnet is withdrawn from the coil, field into the coil decreases. To increase this field, current induced in the coil must be clockwise as seen by the withdrawing magnet.

29. **Ans:**(c)

For the lens, $\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} - \frac{1}{30} = \frac{1}{60}$

v = 60 cm.

Therefore, to have an inverted image of the object, coincident with it, image should tend to form at centre of curvature of convex mirror. Therefore, distance of convex mirror from the lens = 60 – 10 = 50 cm.

30. **Ans:**(b)

For dark fringes,

$Y_n = (2n - 1) \dfrac{\lambda D}{2d} \Rightarrow Y_3 = \dfrac{5}{2} \dfrac{\lambda D}{d}$

For bright fringes,

$Y_n = \dfrac{n\lambda D}{d} \Rightarrow Y_5 = \dfrac{5\lambda D}{d}$

$Y = Y_5 - Y_3$

$Y = \dfrac{5\lambda}{2} \dfrac{D}{d} = \dfrac{5 \times 6.5 \times 10^{-7} \times 1}{2 \times 10^{-3}}$

$= 1.625 \times 10^{-3}$ m = 1.63 mm

31. **Ans:**(d)

Here, power of the bulb, P = 100 W

Supply voltage, ε = 230 V

Let R be the resistance of the bulb.

As $P = \dfrac{\varepsilon^2}{R} \Rightarrow R = \dfrac{\varepsilon^2}{P} = \dfrac{(230)^2}{100} = 529\ \Omega$

Changed supply voltage, ε' = 115 V

Heat and light energy produced by the bulb in 20 min.

$= \dfrac{\varepsilon'^2 t}{2} = \dfrac{115^2 \times 20 \times 60}{529} = 30{,}000$ J = 30 kJ

32. **Ans:**(b)

As $V_C = \varepsilon\left(1 - e^{-t/RC}\right)$

or $1 - e^{-t/RC} = \dfrac{V_C}{\varepsilon} = \dfrac{120}{200} = \dfrac{3}{5}$

or $e^{-t/RC}$ = 2.5 or $\log e^{-t/RC} = \log_e 2.5$

or $\dfrac{t}{RC}$ = 2.3026 $\log_{10}$ 2.5 = 0.92

or R = $\dfrac{t}{0.92C}$ = $\dfrac{5}{0.92 \times 2 \times 10^6}$ = 2.7 $\times$ 10$^6\Omega$

33. **Ans:**(a)

$\varepsilon = -\dfrac{d\phi}{dt} = -\dfrac{d}{dt}(50t^2 + 4) = -100t$

When t = 2s, $|\varepsilon|$ = 200 V
Induced current at t = 2 s,

I = $\dfrac{|\varepsilon|}{R}$ = $\dfrac{200}{400}$ = 0.5 A

34. **Ans:**(d)

Frequency remains unchanged with change of medium.

μ(refractive index) = $\dfrac{c}{v}$ = $\dfrac{1/\sqrt{\varepsilon_0\mu_0}}{1/\sqrt{\varepsilon\mu}}$ = $\sqrt{\varepsilon_r\mu_r}$

Since, μ_r is very close to 1, $\mu = \sqrt{\varepsilon_r}$ = $\sqrt{4}$ = 2

Thus, λ_{medium} = $\dfrac{\lambda}{\mu}$ = $\dfrac{\lambda}{2}$

35. **Ans:**(b)

Total average energy density of electromagnetic wave is

$<u>$ = $\dfrac{1}{2}\varepsilon_0 E_{rms}^2$ + $\dfrac{1}{2\mu_0}B_{rms}^2$

= $\dfrac{1}{2}\varepsilon_0 E_{rms}^2$ + $\dfrac{1}{2\mu_0}\left(\dfrac{E_{rms}^2}{c^2}\right)$ $\qquad$ $\left(\because\ B_{rms}\ \dfrac{E_{rms}}{c}\right)$

= $\dfrac{1}{2}\varepsilon_0 E_{rms}^2$ + $\dfrac{1}{2\mu_0}E_{rms}^2$ + $\varepsilon_0\mu_0$

= $\dfrac{1}{2}\varepsilon_0 E_{rms}^2$ + = $\dfrac{1}{2}\varepsilon_0 E_{rms}^2$ = $\varepsilon_0 E_{rms}^2$

= $(8.85 \times 10^{-12}) \times (720)^2$ = 4.58 $\times$ 10^{-6} J m^{-3}

36. **Ans:**(c)

Here, $A_2 = 2A_1$

$\because$ Intensity $\propto$ (Amplitude)^2

$$\therefore \frac{I_2}{I_1}\left(\frac{A_2}{A_1}\right)^2 = \left(\frac{2A_2}{A_1}\right)^2 = 4$$

$I_2 = 4I_1$

Maximum intensity, $I_m = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

$$= \left(\sqrt{I_1} + \sqrt{4I_2}\right)^2 = \left(3\sqrt{I_1}\right)^2 = 9I_1 \text{ or } I_1 = \frac{I_m}{9} \quad \dots \text{(i)}$$

Resultant intensity, $I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos\phi$

$= I_1 + 4I_1 + 2\sqrt{I_1(4I_1)}\cos\phi$

$= 5I_1 + 4I_1\cos\phi = I_1 + 4I_1 + 4I_1\cos\phi$

$= I_1 + 8I_1\cos^2\frac{\phi}{2} \quad \left(\because 1 + \cos\theta = 2\cos^2\frac{\phi}{2}\right)$

$= I_1\left(1 + 8\cos^2\frac{\phi}{2}\right)$

Putting the value of I_1 from eq. (i), we get

$$I = \frac{I_m}{9}\left(1 + 8\cos^2\frac{\phi}{2}\right)$$

37. Ans:(a)

Here, $u_0 = -5\text{cm}$, $f_0 = 4$ cm

$f_e = 10$ cm, $D = 20$ cm,

According to lens formula,

$$\frac{1}{v_0} = \frac{1}{4} + \frac{1}{-5} = \frac{1}{4} - \frac{1}{5} = \frac{1}{20}$$
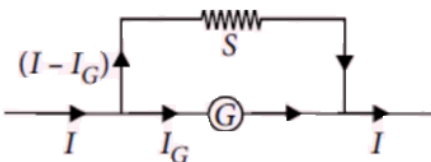
$v_0 = 20$ cm

Magnification, $M = \dfrac{v_0}{|u_0|}\left(1 + \dfrac{D}{f_e}\right)$

$$= \frac{20}{5}\left(1 + \frac{20}{10}\right) = 12$$

38. Ans: (b)

$(I - I_G)S = I_G I_G$

$$S = \frac{I_G G}{(I - I_G)}$$

Here, IG = $\frac{5}{100}$ I

$\therefore$ S = $\frac{\frac{5}{100}IG}{I - \frac{5}{100}I}$ = $\frac{G}{19}$

39. **Ans:**(c)

Resistance of the circuit,
R = R_1 + R_2 = 40 Ω + 40 Ω = 80 Ω
Impendence of the circuit

40. **Ans:**(c)

As R_D = $\frac{V_D^2}{P_D}$ = $\frac{(0.5\ V)^2}{0.1\ W}$ = 2.5 Ω

I_D = $\frac{V_D}{R_D}$ = 0.2 A

Total resistance required in the circuit,

R_{eq} = $\frac{V}{I_D}$ = $\frac{1.5}{0.2}$ = 7.5 Ω

Resistance of the series resistor, R = R_{eq} − R_D

= 7.5 − 2.5 = 5 Ω

41. **Ans:**(c)

As $\frac{N_X}{N_Y}$ = $\frac{1}{15}$, N_X + N_Y = 16N_X

Thus, $\frac{N_X}{N_X + N_Y}$ = $\frac{1}{16}$

or N_X = $\frac{1}{16}$(N_X + N_Y) = $\frac{1}{2^4}$(N_X + N_Y)

Age of the rock = number of half –lives of isotope
X passed = 4 = 4 × 50 years = 200 years

42. **Ans:**(a)

Here, λ = 6.2 × 10^{-6} m, ϕ_0 = 0.1 eV

Energy of the incident photon, E = hυ = $\frac{hc}{\lambda}$

or   E = $\frac{(6.6 \times 10^{-34})(3 \times 10^8)}{6.2 \times 10^{-6}}$ J

$$= \frac{6.6 \times 3 \times 10^{-26}}{(6.2 \times 10^{-6})(1.6 \times 10^{-19})} \, eV = 0.2 \, eV$$

As $E = K + \phi_0$, $K = E - \phi_0$

$= 0.2 \, eV - 0.1 \, eV = 0.1 \, eV$

43. **Ans:**(d)

The far point of 6.0 m tell us that focal length of the lens is f = – 6.0 m, u = – 18 m and h = 2 m

Using, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$

$\Rightarrow \dfrac{1}{v} = \dfrac{1}{f} + \dfrac{1}{u} = \dfrac{1}{-6.0} - \dfrac{1}{18.0}$

$\Rightarrow$ v = – 4.5 m

∴The image size,

$h' = h\left(\dfrac{v}{u}\right) = 2 \times \left(\dfrac{-4.5}{-18.0}\right) = 0.50 \, m$

44. **Ans:** (c)

Energy of incident photon, $E = \dfrac{hc}{\lambda}$

$E = \dfrac{6.6 \times 10^{-34} \times 3 \times 10^8}{2 \times 10^{-7}}$

$= 9.9 \times 10^{-19} \, J = \dfrac{9.9 \times 10^{-19}}{1.6 \times 10^{-19}} \, eV = 6.2 \, eV$

$K_{max} = eV_s = e \times 2.5 \, V = 2.5 \, eV$

According to Einstein's photoelectric equation

$K_{max} = \dfrac{hc}{\lambda} - \phi_0$

Where the symbols have their usual meanings

or $\phi_0 = \dfrac{hc}{\lambda} - K_{max} = 6.2 \, eV - 2.5 \, eV = 3.7 \, eV$

Threshold frequency, $\upsilon_0 = \dfrac{\phi_0}{h}$

$\upsilon_0 = \dfrac{3.7 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-34}}$

$= 0.9 \times 10^{15} \, Hz = 9 \times 10^{14} \, Hz$

45. **Ans:** (d)

When potentiometer is connected between A and B, then it measures only ε_1 and when

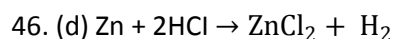connected between A and C, then it measures $\varepsilon_1 - \varepsilon_2$.

∴$\dfrac{\varepsilon_1}{\varepsilon_1 - \varepsilon_2} = \dfrac{l_1}{l_2}$, $\dfrac{\varepsilon_1 - \varepsilon_2}{\varepsilon_1} = \dfrac{l_2}{l_1}$

or $\quad 1 - \dfrac{\varepsilon_2}{\varepsilon_1} = \dfrac{100}{300}$ or $\dfrac{\varepsilon_2}{\varepsilon_1} = 1 - \dfrac{1}{3}$

or $\quad \dfrac{\varepsilon_2}{\varepsilon_1} = \dfrac{2}{3}$ or $\dfrac{\varepsilon_1}{\varepsilon_2} = \dfrac{3}{2}$

PART – B (CHEMISTRY)

46. c	47. a	48. d	49.d	50. b	51. c	52.b	53. c	54. d	55. c
56. d	57. d	58. c	59. d	60. b	61. c	62. b	63. a	64. a	65. d
66. b	67. a	68. c	69. b	70. b	716. a	72. a	73. a	74. b	75. c
76. a	77. d	78. b	79. d	80. d	81. a	82. b	83. a	84. c	85. b
86. c	87. b	88. c	89. b	90. b					

SOLUTIONS:

46. (d) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

$\quad n_{zn} = \dfrac{6.5}{65} = 0.1$

$\quad n_{H_2}$ formed = 0.1

$\quad H_2 + \dfrac{1}{2}O_2 \rightarrow H_2O$
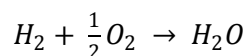
$\quad n_{H_2O}$ formed = 0.1

$\quad W_{H_2O} = 18 \times 0.1 = 1.8$gm

47. (a) As oxidation no. ↑, percentage decreases

48. (d) $\dfrac{r_{H_2}}{r_{gas}} = \sqrt{\dfrac{M_{gas}}{2}}$

$\quad \dfrac{r_{H_2}}{10} = \sqrt{\dfrac{72}{2}}$

$\quad r_{H_2} = 60 \; ml/sec$

49. (d) Total VP = $150 \, x_B + 50 x_T$

$\qquad\qquad = 150 \, x_B + 50 \, (1 - x_B)$

$\qquad\qquad = 50 + 100 \, x_B$

$\quad 150 \, x_B = (50 + 100 \, x_B) \times 0.4$

$\quad 150 \, x_B = 20 + 40 \, x_B \qquad \Longrightarrow \qquad x_B = \dfrac{20}{110} = 0.18$

50. (b) $[OH^-] = 10^{-3}$

$\quad [H^+] = 10^{-11}$

$$H^+_{(aq)} + e^- \rightarrow H_2(g)$$
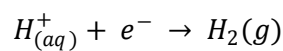
$$E_{reduction} = 0 - \frac{0.0591}{1} \log \frac{1}{10^{-11}}$$

$$= -0.0591 \times 11$$

$$= -0.6501$$

51. (c) $2H^+ + 2e^- \rightarrow H_2$
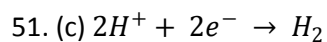
$$n_{H_2} = \frac{560}{22400} = 0.025$$

Charge passed = $2 \times 0.025\ F$

$$= 0.05\ F$$

$$S^{-2} \rightarrow S + 2e^-$$
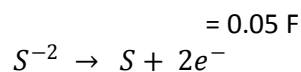
$n_{sulp\ hur}$ deposited = 0.025

m_s deposited = $0.025 \times 32 = 0.8$ gm

52. (b) Conceptual

53. (c) $E_{quino\ hydrone} = 1.3 - \frac{0.0591}{2} \log [H^+]^2$

$$= 1.3 - \frac{0.0591}{2} \times -4$$

$$= 1.42V$$

54. (d) $Mg_2C_3 + 2H_2O \rightarrow C_3H_4 + 2MgO$

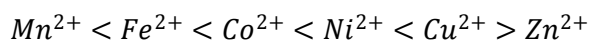55. (c) This is due to back – bonding .

56. (d) Conceptual

57. (d) Conceptual

58. (c) Conceptual

59. (d) Conceptual
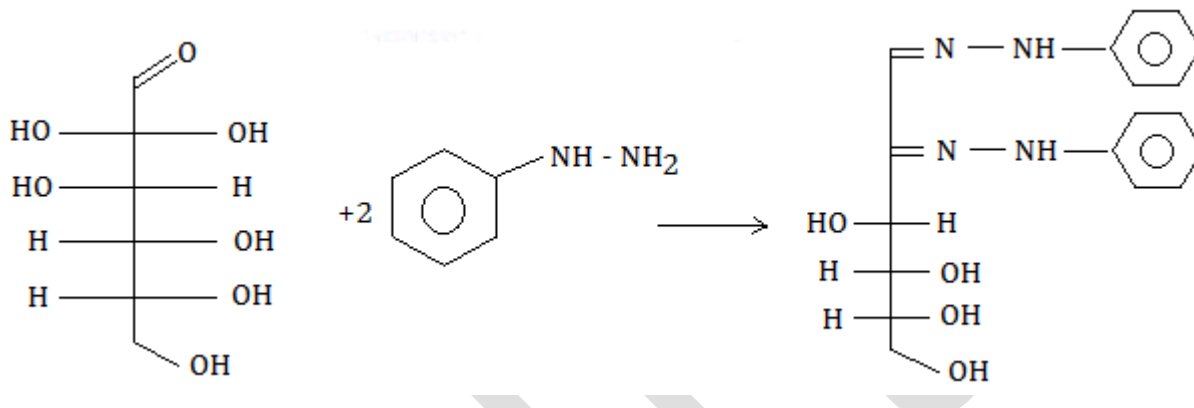
60. (b) % [B] = $\frac{K_1}{K_1 + K_2} \times 100$

$$= \frac{12..6 \times 10^{-4}}{12.6 \times 10^{-4} + 3.8 \times 10^{-4}} \times 100$$

$$= 76.83\ \%$$

%[c]   = 100 − 76.83 = 23.17%

61. (c) Irving William order
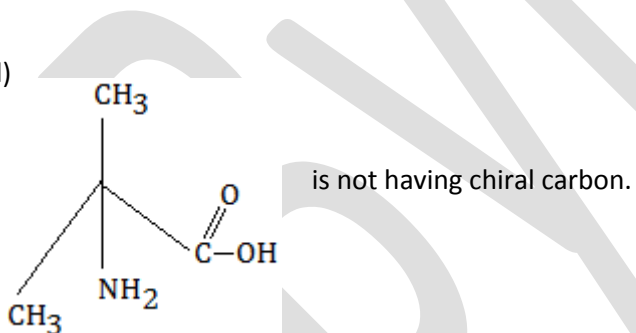
$$Mn^{2+} < Fe^{2+} < Co^{2+} < Ni^{2+} < Cu^{2+} > Zn^{2+}$$

62. (b)

63. (a) Conceptual

64. (a) azo group is responsible for colour.

65. (d)

is not having chiral carbon.

66. (b) Conceptual

67. Diagram
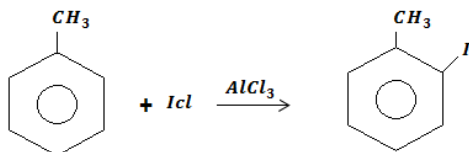
68. (C) Benzyl carbocation is more stable

69. Sol: (b)
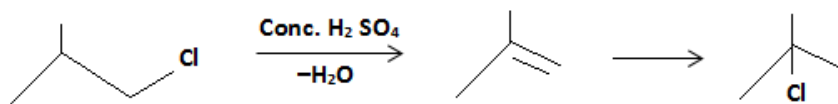
70. Sol: (b) trans + syn→ Recemic mixture

71. Sol: (a)
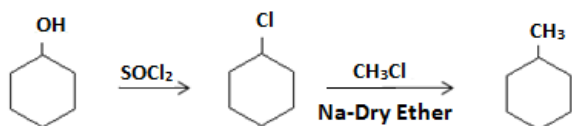
72. sol: (a)   Conceptual

73. Sol: (a) Oxymercuration – demercuration reaction gives Menkovnikov's addition of OH.

74. Sol: (b) Conceptual

75. Sol: (c) Conceptual

76. Sol: (a) F is a deactivating group

77. Sol: (d) Hoffman bromamide degradation reaction

78. Sol: (b)

79. Sol: (d) Conceptual

80. Sol: (d) Conceptual

81. Sol: (a)

82. Sol: (b) H_2O forms hydrogen bond with another H_2O molecule

83. Sol: (a) There is bridge bonding

84.(C) $Na_2SO_4 \rightarrow 2Na^+ \quad + \quad SO_4^{-2}$

0.004(1-α)   0.008 α 0.004 α

Now

0.004(1- α) + 0.008 α+ 0.004 α=0.01

0.008 α= 0.01 - 0.004

0.008 α = 0.006

$$\alpha = \frac{6}{8} = 0.75$$

Percentage dissociation   = 75%

85. Sol: (b) For isothermal process $\Delta U = 0$
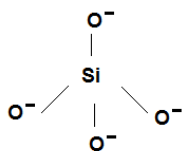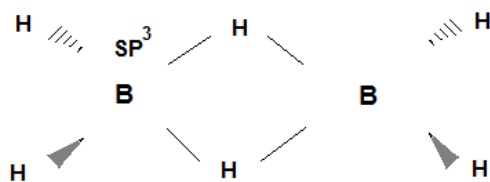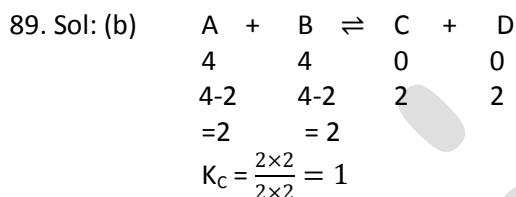
86. Sol: (c) Sulphides are more covalent because of bigger size

87. Sol: (b) Conceptual

88. Sol: (c) Conceptual

89. Sol: (b)   A   +   B $\rightleftharpoons$ C   +   D
                 4   4   0   0
                 4-2   4-2   2   2
                 =2   = 2
                 $K_C = \frac{2\times2}{2\times2} = 1$

90. Sol: (b)
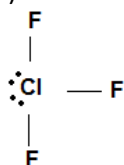
PART – C (BIOLOGY)

91.c	92.d	93.d	94.a	95.d	96.b	97.c	98.b	99.d	100.c
101.d	102.c	103.d	104.d	105.d	106.d	107.c	108.a	109.c	110.c
111.c	112.a	113.b	114.d	115.d	116.c	117.b	118.b	119.b	120.d
121.c	122.a	123.b	124.b	125.c	126.c	127.d	128.a	129.d	130.a
131.b	132.d	133.c	134.d	135.a	136.a	137.a	138.d	139.c	140.b
141.a	142.b	143.c	144.b	145.c	146.c	147.a	148.c	149.c	150.c
151.d	152.d	153.d	154.d	155.b	156.b	157.b	158.a	159.d	160.a
161.b	162.c	163.d	164.d	165.b	166.b	167.c	168.b	169.b	170.b
171.b	172.c	173.b	174.d	175.d	176.b	177.b	178.d	179.b	180.b

SOLUTION:

91. (c) Solution:Herbarium and museums have preserved plant specimens. Botanical gardens are collections of living plants Manuals are useful in providing information for identification of names of species found in an area.

92.(d)Solution:Human being is the only organism who has self-consciousness

93.(d)Solution:protozoans are protists that lack cell wall

94.(a)Solution: R. H. Whittaker recognized an additional kingdom for the Fungi.

95.(d)Solution:sex organs are absent in basidiomycetes and deuteromycetes.

96.(b)Solution: Mycoplasmas(Monera) are organisms that completely lack a cell wall. protozoans (Protista)lack cell wall

97.(c)Solution:volvox produces hetero gametes(oogamy)

98. (b)Solution: Majority of the pteridophytes, are homosporous. Very few are heterosporus.Gametophyte of pteridophyte is independent.

99.(d)Solution: Tapeworm, liver fluke and planarians belong to Platyhelminthes which are flatworms having a flattened body

100.(c)Solution:Fertilization is internal in most arthropods but not all groups

101.(d)Solution:Axile placentation is seen in multilocular ovary.

102.(c) Solution: All bisexual flowers are not complete as sometimes they lack non essential whorls.

103.(d) Solution:The "eyes" on a potato tuber are nodes from which new plants arise.

104. (d)Solution: fodder :-Sesbania, Trifolium

105.(d) Solution:Beneficial elements are sodium, silicon, cobalt and selenium. They are required by higher plants but not absolutely essential.

106.(d) Solution: glucose undergoes partial oxidation to form two molecules of pyruvic acid and carbon dioxide is not released.

107.(c) Solution:In C3 plants ,3-phosphoglycerate (3-PGA)is the first stable product and is a C3 compound and inC4 plants it is Oxaloacetate (OAA), a four carbon compound.

108.(a) Solution: cell membrane is composed of lipids that are arranged in a bilayer. Lipids are arranged within the membrane with the polar head towards the outer sides and the hydrophobic tails towards the inner part.This ensures that the nonpolar tail of saturated hydrocarbons is protected from the aqueous environment

109.(c)Solution:endosperm results from triple fusion and is triploid.

110. (c) Solution: sugars are loaded (actively transported) into a sieve tube

111. (c)Solution: Saccharumofficinarum grows in South India .Semi-dwarf varieties are developed from IR-8 .

112.(a) Solution: sodium-potassium pump moves 3 sodium ions out & moves 2 potassium ions in

113.(b) Solution: gonadotropin-releasing hormone (GnRH) is secreted from the hypothalamus.

114.(d) Solution:sclerenchyma is a dead mechanical tissue.

115. (d)Solution:Endosperm is triploid.

116.(c) Solution:secondary succession is fast.In successive seral stages, there is change in the diversity of species of organisms

117.(b) Solution: Haploid production occurs through anther or pollen culture.

118.(b) Solution: The fish gets protection from predators.The anemone does not appear to derive any benefit by hosting the clown fish.

119.(b) Solution: In the stratosphere, chlorine atoms react with ozone molecules to form chlorine monoxide and oxygen.This reaction causes the depletion of the ozone layer

120.(d)The various phases of menstrual cycle.

121. (c) Solution: RNA interference (RNAi) is a post-transcriptional process triggered by the introduction of double-stranded RNA (dsRNA) which leads to gene silencing in a sequence-specific manner.
122. (a) Solution:the plane of binary fission in paramecium is transverse.

123. (b) Solution:Carbon monoxide (CO) is only a very weak direct greenhouse gas, but has important indirect effects on global warming.

124.(b) Solution:DNA is composed of 4 nucleotides and RNA is composed of four nucleotides.so total 8.

125.(c) Solution: Biochemical nature of genetic material is not known from Griffith's experiment. Avirulent bacteria is transformed. S strain is virulent as it has capsule

126. (c) Solution: DNA has the code for protein synthesis.

127.(d) Cytokinins have specific effects on cytokinesis, and were discovered as kinetin (a modified form of adenine, a purine) from the autoclaved herring sperm DNA. Kinetin does not occur naturally in plants

128.(a) Solution:Radial in roots,collateral in stems and bicollateral in cucurbita.

129. (d)Solution:Insulin ,growth hormone and tpa are all produced by r DNA technology

130.(a) Solution: when TtRr is self pollinated,two out of 16 plants are showing both the characters dwarf and pink.

131. (b)Solution:About seven percent of carbon dioxide is transported to the lungs in dissolved state.

132.(d) Solution:All are incorrect except saddle joint.saddle joint is a synovial joint.

133.(c)Solution:parathyroid gland secretion increases calcumlevel,melatonin-pineal gland,renin –JG cells of afferent arteriole.

134. (d) Solution: Human chorionic gonadotropin, human placental lactogen and relaxin are produced only during
pregnancy.

135.(a) Solution:LNG-20 is a hormone releasing IUD.

136.(a) Solution:Active sites are unmasked when calcium binds with a subunit of troponin

137.(a) Solution:GIFT involves ovum collected from a donor into the fallopian tube of another woman who cannot produce one

138.(d) Solution: The frequency of dominant allele is asked. P value should be calculated.
p^2 has to be calculated first and then find out p.

139. (c)Solution:Saccule and utricle contain macula.

140.(b) Solution: prokaryotic ribosomes are 70 S, ribosomes are found in prokaryotic cells also.mitochondria has70 S ribosomes.

141.(a) Solution: species diversity decreases as we move away from the equator towards the poles. Genetic diversity increases with environmental variability

142.(b) Solution:colour blind man with hypertrichosis marries a carrier woman.we can predict the progeny. Half ofthe male children are with both colorblindness and hypertrichosis

143.(c) Solution:Random changes in gene frequencies due to chance in small population is called genetic drift.

144.(b) Solution:Thymine is replaced by uracil which is a Pyrimidine.

145.(c) Solution: Parents are pure homozygotes.

146.(c) Solution: Taq DNA polymerase extends the primers using the nucleotides provided in the reaction and the genomic DNA as template

147.(a) Solution: When pollen is shed at the two-cell stage, double fertilization will take place. In over 60 per cent of angiosperms, pollen grains are shed at this 2-celled stage. In such plants, the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma.

148.(c) Solution: restriction site of Pvu II is present in rop region. Rop codes for the proteins involved in the replication of the plasmid.

149.(c) Solution: Heroin is obtained by acetylation of morphine

150.(c) Solution:plasmodium attacks liver cells and RBC.

151.(d) Solution:Non random mating will change gene frequency not random

152.(d) Solution:Homo erectus ate meat.

153.(d) oxytocin is produced from hypothalamus.

154.(d) Solution:apoenzyme-proteinpart.haem is prosthetic group of catalase.ribozymes are RNA.

155.(b) Solution: In a polysaccharide chain,the right end is called the reducing end and the left end is called the non-reducing end. Nucleotide is the building block of nucleic acids

156.(b)refer the reproductive system of cockroach.

157.(b) Solution: Small amounts of lipases are also secreted by gastric glands. Nucleases in the pancreatic juice acts on nucleic acids to form nucleotides and nucleosides

158.(a) Solution:plasma proteins due to high molecular weight.

159.(d) Solution: residual, persistent nucellus is the perisperm. The zygote gives rise to the proembryo and subsequently to the globular, heart-shapedand mature embryo In Monocots, Epicotyl has a shoot apex and a few leaf primordia enclosed in a hollow foliar structure, the coleoptile

160.(a) Solution:pollen mother cell undergoes meiosis and forms microspores.

161.(b) Solution: smooth muscle fibres perform slow and sustained contractions. Do not show striations due to irregular arrangement of actin and myosin filaments.

162.(c) Solution:Rudolf Virchow first explained that cells divide and new cells are formed from pre-existing cells omniscellula e cellula,(Every cell comes from another cell)

163.(d) Solution: Water 70-90%,Proteins 10-15%,Carbohydrates 3%,Lipids 2%,Nucleic acids 5-7%

164.(d) Solution: Centromeres split and sister chromatids separate.

165.(b) Solution: Pairing of homologous chromosomes at the metaphase plate occurs in meiosis but not in mitosis.

166.(b) Solution: prophase--spindle appears

167.(c) Solution: glyceraldehyde phosphate is triose ,erythrose is tetrose

168.(b) Solution:photolysis of water occurs in lumen which releases oxygen.

169.(b) Solution: Kreb's cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid

170.(b)Match the following is regarding nodal tissue of the heart.

171.(b) Solution:Each peak in the ECG is identified with a letter from P to T.

172.(c) Solution:Hypothalamus is a part of prosencephalon(fore brain)

173.(b) Solution:ovary,testes and pancreas perform many functions apart secreting hormones.

174.(d) Solution:Seed bank ,Zoological park and In vitro fertilization - Ex situ conservation.

175.(d) Solution:Primary spermatocyte undergoes meiosis-I & forms two secondary spermatocytes.

176.(b) Solution:XX-XO type of sex determination is seen in grass hopper where males are XO and females are XX.

177.(b)BOD(biological oxygen demand.) - Measure of organic matter in water

KVIC-khadi and village industries commission(bio gas)

LAB-lactic acid bacteria

STPS-sewage treatment plants

178.(d) RNAi used against Meloidogyne.ELISA-detects AIDS
Cry genes against insect pests.

179.(b) Solution: Some examples of recent extinctions include the dodo (Mauritius), quagga (Africa), thylacine (Australia), Steller's Sea Cow (Russia)

180.(b) Solution:Gause's'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.