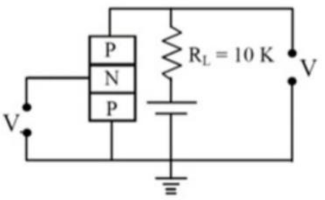
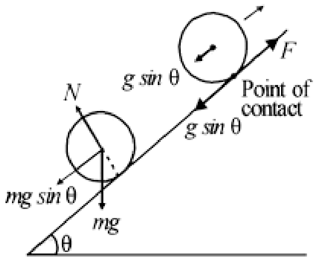
1. (c)



The P-N junction which is forward biased is the emitter - base pair of the transistor . Hence the common junction is collector, so it is a common collector circuit

2. (b)While ascending the cylinder tries to pull the ground backwards while moving forward, thus frictional force acts upwards. During descending the frictional force again acts upwards. If friction were absent the body would slide down. Thus the frictional force in this case is responsible for rolling motion of the cylinder



When cylinder rolls up the incline angular velocity decreases for that torque of friction should be in opposite direction of angular velocity . Therefore friction must be acting up the incline
When cylinder rolls down the incline angular velocity increases for that torque of friction should be in opposite direction of angular velocity . Therefore friction must be acting up the incline

3. (d)Kinetic energy of the emitted photoelectrons varies from zero to a maximum value

4. (d) $KE_{rotational} = \frac{1}{2}I\omega^2$

$$KE_{rotational} = \frac{1}{2}\left(\frac{1}{2}(4)(1)^2\right)(0.1)^2$$

$$KE_{rotational} = 0.01J$$

5. (c)Minimum angular separation between two stars whose image is just resolved by telescope is

$$\Delta\theta = \frac{1.22\lambda}{a}$$

$$\therefore \Delta\theta = \frac{1.22\times 5000\times 10^{-10}}{2}$$

$$\Delta\theta = 3050\times 10^{-10} = 3.05\times 10^{-7} \text{ rad}$$

$$\Delta\theta \approx 0.31\times 10^{-6} \text{ rad}$$

6. (b)Ratio of potential of the bigger drop to smaller drop is given by

$$\frac{v}{v_0} = n^{\frac{2}{3}} = 1000^{\frac{2}{3}} = 100$$

7. . (d) $I = \frac{1}{2}\rho\omega^2 A^2 v$

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

$$\frac{I_1}{I_2} = \left(\frac{75}{150}\right)^2\left(\frac{5}{10}\right)^2$$

$$\frac{I_1}{I_2} = \frac{1}{16}$$

8. (c)Pitch of helical path is

$$P = (v\cos\theta)\times\frac{2\pi m}{qB} = \frac{2\pi mv\cos 45^0}{qB}$$

$$p = \frac{2\pi mv}{\sqrt{2}qB}$$

Also radius of helix is, $r = \frac{mv\sin\theta}{qB} = \frac{mv}{\sqrt{2}qB}$

$$\therefore \frac{r}{p} = \frac{mv}{\sqrt{2}qB}\times\frac{\sqrt{2}qBB}{2\pi mv} = \frac{1}{2\pi}$$

Or $r = \frac{p}{2\pi}$

9. (b)Induced current is,

$$i = \frac{1}{R}\left(N\frac{d\phi}{dt}\right) = \frac{1}{2}\left(NA\frac{dB}{dt}\right)$$

$$i = \frac{1}{20}(10)\left(10\times 10^{-4}\right)\left(10^4\right) = 5A$$

$$i = 5A$$

10. (c)Increase in energy of CO_2 = loss in energy of O_2

$$n_1C_{v_1}(T - T_1) = n_2C_{v_2}(T_2 - T)$$

$$3(T - 27) = \frac{1}{2}5(37 - T)$$

$$T = 31.5^0C;$$

11. **(a)**

In tan A position $\frac{2kM}{r^3} = B_H \tan\theta$

$$\left(\frac{r_1}{r_2}\right)^3 = \frac{\tan\theta_2}{\tan\theta_1} \Rightarrow \theta_2 = 30^0$$

12. (b)Substance remained after time t, $N = N_0 e^{-\lambda t}$

Mean life of radioactive sample is, $t_{mean} = \frac{1}{\lambda}$

$\therefore$ Substance remained after mean life $N = N_0 e^{-1}$

$N = (0.37) N_0$

$\therefore$ Substance disintegrated $N_0 - N = 0.63 N_0$

i.e 63%, nearly $\frac{2}{3}$

13. (a)

According to Kepler's law $T \propto R^{3/2}$

$\therefore T_{planet} = (5)^{3/2}\, T_{earth} = 5^{(3/2)} \times 1\, year = 5^{3/2}\, years$.

14. (c)

By using $P = \frac{W}{t} = \frac{n \times E}{t}$ where n = Number of uranium atom fissioned and E = Energy released due to each fission so $300 \times 10^6 = \frac{n \times 170 \times 10^6 \times 1.6 \times 10^{-19}}{3600} \Rightarrow n = 40 \times 10^{21}$

15. (d)Applying conservation of momentum

$$m(6.6)\hat{i} + 0$$
$$= m\left(3.3\cos 60^0\, \hat{i} + 3.3\sin 60^0\, \hat{j}\right) + m\vec{v}$$
$$\vec{v} = 4.95\hat{i} - 2.85\hat{j}$$
$$v = 5.7 m/s$$

16. (a)Current is $I = 2\sin \omega t A$

Voltage is $E = \cos \omega t = 2\sin\left(\omega t + \frac{\pi}{2}\right)V$

$P = V_{rms}\ \ I_{rm} \cos\phi$
$= V_{rms}\, I_{rms} \cos 90^\circ$

The phase difference is of $\frac{\pi}{2}$, so power factor is zero.

Therefore average power dissipated in the instrument is zero.

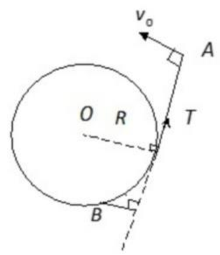
17. (b)Input supply is e = 50 sin (314t) volt

So frequency is $f = \frac{\omega}{2\pi} = \frac{314}{2\pi}$

$f = 50 Hz$

18. *(d)Since torque about point O due to force by string is non zero (as angle between OA and AB is non zero), angular momentum is not constant.(Since T=dL/dt)*

Same reason as part 1. Since angle between force by string and AB will vary from 0 as particle will move.
Since velocity of particle is continuously changing, direction of momentum is changing and hence momentum is not constant.
Since work done by the string force is zero as velocity is perpendicular to force, change in kinetic energy is 0 and hence kinetic energy remains constant.



From the diagram , we can see that net torque about Q and B is not zero . There fore angular momentum changes about these poins. As the tension is always perpendicular to velocity therefore work done is zero and speed remains constant and hence the kinetic energy
But the direction of velocity changes continuous and hence momentum changes

19. (b)$U = 2X^4 - 27X$

$$\frac{du}{dx} = 8x^3 - 27$$

At $x = \frac{3}{2} . \frac{dU}{dx} = 0$, therefore it is an equilibrium position.

$$\left(\frac{d^2U}{dX^2}\right) = 24X^2$$

At $x = \frac{3}{2}, \frac{d^2U}{dx^2} > 0$, therefore it is a stable equilibrium position

20. (d)Resistance of a wire is

$$R = \frac{\rho l}{A}$$
$$\frac{\Delta R}{R} = \frac{\Delta l}{l} - \frac{\Delta A}{A} = 1 - (-1) = 2\%$$

21. (a) $KE_{trans} = \frac{3}{2} PV$

$$KE_{trans} = \frac{3}{2}\left(10^5\right)\left(10^{-6}\right)$$
$$KE_{trans} = 0.15 J$$

22. (b) $\frac{hc}{\lambda_1}+\frac{hc}{\lambda_2}=RCz^2\left(\frac{1}{l^2}-\frac{1}{n^2}\right)$

Put $\lambda_1=1026.7A^0$ and $\lambda_2=304A^0$

$Z=2$ for He^+ ion

On solving for n

$n=6$

23. (b)Density of hot air is lesser than the density of cold air so hot air rises up

24. **(d)**

When needle oscillates in horizontal plane

Then it's time period is $T=2\pi\sqrt{\frac{I}{MB_H}}$ ......(i)

When needle oscillates in vertical plane *i.e.* It oscillates in total earth's total magnetic field (B)

Hence $T'=2\pi\sqrt{\frac{I}{M}}$ .....(ii)

Dividing equation (ii) by (i)

$$\frac{T'}{T}=\sqrt{\frac{B_H}{B}}=\sqrt{\frac{B\cos\phi}{B}}=\sqrt{\cos 60}=\frac{1}{\sqrt{2}}\Rightarrow T'=\frac{T}{\sqrt{2}}$$

25. (b)Radius of the circular horizon is

$$r=\frac{h}{\sqrt{\mu^2-1}}$$

$$r=\frac{12}{\sqrt{\left(\frac{4}{3}\right)^2-1}}$$

$$r=\frac{36}{\sqrt{7}}cm$$

26. . (d) $T=2\pi\sqrt{\frac{1}{g}}$

$$\frac{\Delta T}{T}=\frac{1}{2}\frac{\Delta 1}{1}$$

$$\Delta T=\frac{1}{2}\propto\Delta\theta.T$$

$$\Delta T=\frac{1}{2}\left(1.2\times10^{-5}\right)(30-20)(3600\times24\times7)$$

$$\Delta T=36.28\sec$$

27. (a)Focal length of equiconcave lence

$$f=\frac{-R}{2(\mu-1)}$$

Where $\mu=\frac{\mu_{lens}}{\mu_{medium}}$

Therefore focal length in the medium

$$f_{med}=\frac{-R}{2\left(\frac{1.5}{1.75}-1\right)}$$

$$f_{med}=+\frac{R}{2\left(\frac{0.25}{1.75}\right)}$$

$$f_{med}=+3.5R$$

Positive sign implies convergent sign

28. (a)From $E=E_0\sin\left[1.57\times10^7(x-ct)\right]$ frequency of incident wave is,

$$v=\frac{\left(1.5\times10^7\right)c}{2\pi}$$

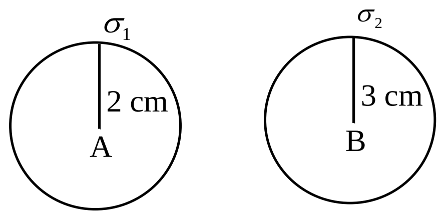
For stopping potential,

$$eV_s=hv-\varphi$$

$$V_S=\frac{\left(6.626\times10^{-34}\right)\left(1.57\times10^7\right)\left(3\times10^8\right)}{2\pi\left(1.6\times10^{-19}\right)}-1.9$$

$$V_S=1.2V$$

29. (c)



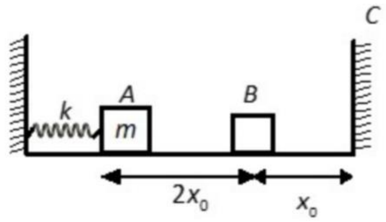
$$V_1=\frac{\sigma_1 r}{\varepsilon_0}=\frac{\sigma_1\times2}{\varepsilon_0}$$

$$V_2=\frac{\sigma_2 R}{\varepsilon_0}=\frac{\sigma_2\times3}{\varepsilon_0}$$

As the spheres are charged to same potential.

$$\therefore\frac{\sigma_1\times2}{\varepsilon_0}=\frac{\sigma_2\times3}{\varepsilon_0}$$

$$\therefore\frac{\sigma_1}{\sigma_2}=\frac{3}{2}$$



30. (c)

In diagram B denotes the mean position
Let T be time period of oscillation of the spring -mass system

Time from B to C , t_{BC} can be given by

$$BC = AB\sin\left(\frac{2\pi}{T}t_{BC}\right)$$

$$\frac{BC}{AB} = \frac{X_0}{2X_0} = \frac{1}{2}$$

$$t_{BC} = \frac{T}{12}$$

The total time from A to C

$$t_{AC} = t_{AB} + t_{BC} = \frac{T}{4} + \frac{T}{12} = \frac{T}{3}$$

$$t_{AC} = \frac{2\pi}{3}\sqrt{\frac{m}{k}}$$

31. (c)Coercivity is H = 2×10^3

For a solenoid, H = ni
Number of turns per unit length

$$n = \frac{150}{15\times10^{-2}} = 1000$$

$$\Rightarrow i = \frac{H}{n} = \frac{2\times10^3}{10^3} = 2A$$

32. (c)If height of stones is h_1 and h_2 after

T=3s then,

$$h_1 = 100 - \frac{1}{2}gt^2 = 55m$$

$$h_2 = 100 - \frac{1}{2}gt^2 = 55m$$

$$h_{cm} = \frac{m_1h_1 + m_2h_2}{m_1 + m_2} = \frac{m(55+55)}{2m}$$

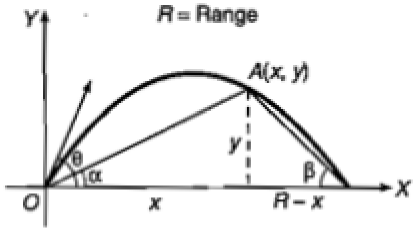
$$h_{CM} = 55m$$

33. (d)For a uniform wire, resistances are in the ratio of lengths only.

34. (d) ${}_0n^1 \rightarrow {}_1P^1 + {}_{-1}e^0 + \bar{v}$

The electron comes out with a spectrum of energies . The energy released is shared between elelctron and neutrino

35. (b)



$$\tan\alpha + \tan\beta = \frac{y}{x} + \frac{y}{R-x}$$

$$\tan\alpha + \tan\beta = \frac{yR}{x(R-x)} \quad ...(i)$$

Equation of trajectory is

$$y = x\tan\theta\left[1 - \frac{x}{R}\right]$$

$$\text{or, } \tan\theta = \frac{yR}{x(R-x)} \quad ...(ii)$$

From Eqs. (i) and (ii), we have

$$\tan\theta = \tan\alpha + \tan\beta$$

36. (a)At X=0

$$K = \frac{1}{2}\times2\times80 = 80J$$

$$U = 15J$$

$\therefore$ Total energy is,

$$E = K + U = 95J$$

Force $F = \frac{-dU}{dx}$

F = $3x^2 - 12x$

For F to be minimum , $\frac{dF}{dx} = 0$

$\Rightarrow$ X=2m
At x=2m
E=K+U

$$\Rightarrow 95 = \frac{1}{2}\times2\times V^2 + (-8+24+15)$$

$$\Rightarrow V = 8m/s$$

37. (b)From Stefan's law

$$-\frac{\Delta Q}{\Delta t} = \sigma A\left(T^4 - T_0^4\right)$$

$$mc\left(-\frac{\Delta Q}{\Delta t}\right) = \sigma A\left[\left(T_0 - \Delta T\right)^4 - T_0^4\right]$$

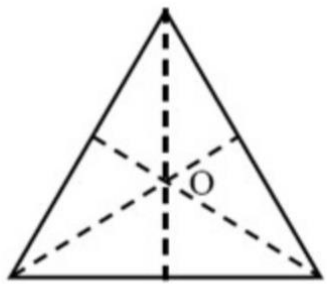
$$\left(-\frac{\Delta T}{\Delta t}\right) = \frac{\sigma A T_0^4}{mc}\left[\left(1 - \frac{\Delta T}{T_0}\right)^4 - 1\right]$$

$$\left(-\frac{\Delta T}{\Delta t}\right) = \frac{\sigma\left(4\pi T^2\right)T_0^4}{\left(d\frac{4}{3}\pi r^3\right)c}\left[1 + \frac{4\Delta T}{T_0} - 1\right]$$

[as $\Delta T << T_0$]

$$\left(-\frac{\Delta T}{\Delta t}\right)=\frac{12\sigma T_0^3\Delta T}{RDc}$$

38. (b)



Momentum of inertia of any one side about its perpendicular bisector is

$$I_{cm}=\frac{1}{2}\left(\frac{M}{3}\right)\left(\frac{L}{3}\right)^2$$

Momentum of inertia of this rod about O

$$I=I_{cm}+Md^2$$

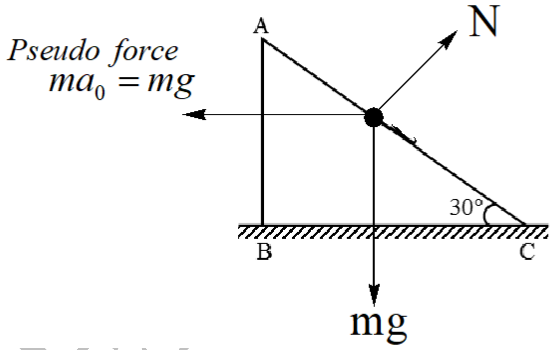
$$I=\left[\frac{1}{12}\left(\frac{M}{3}\right)\left(\frac{L}{3}\right)^2+\left(\frac{M}{3}\right)\left(\frac{1/3}{2\sqrt{3}}\right)^2\right]$$

$$I=\frac{ML^2}{162}$$

Momentum of inertia of a triangle

$$I_{Truin}=3I=\frac{ML^2}{54}$$

39. (b)Drawing a free body diagram of the block with respect to the plane



Acceleration of the block up the plane is

$$a=\frac{mg\cos 30^0-mg\sin 30^0}{m}$$

$$=\left(\frac{\sqrt{3}-1}{2}\right)g=3.66m/s^2$$

Applying $S=\frac{1}{2}at^2$

$$t=\sqrt{\frac{2s}{a}}=\sqrt{\frac{2\times 1}{3.66}}=0.74s$$

40. (b)

Percentage change in g when the body is raised to height h,

$$\frac{\Delta g}{g}\times 100\,\%=\frac{2h\times 100}{R}=1\%$$

Percentage change in g when the body is taken into depth d,

$$\frac{\Delta g}{g}\times 100\,\%=\frac{d}{R}\times 100\,\%=\frac{h}{R}\times 100\,\%\ \text{[As } d=h\text{]}$$

$\therefore$ Percentage decrease in weight

$$=\frac{1}{2}\left(\frac{2h}{R}\times 100\right)=\frac{1}{2}(1\%)=0.5\%.$$

41. (a)Time period of oscillation of a magnet is

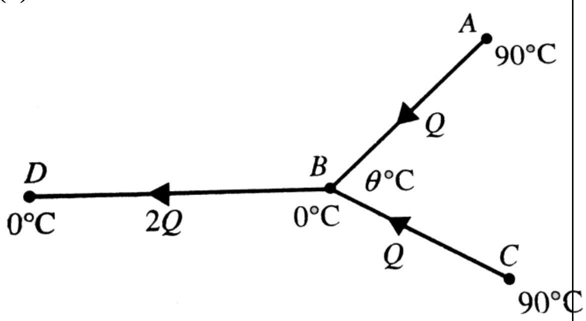
$$T=2\pi\sqrt{\frac{1}{MB}}$$

$$\frac{T_2}{T_1}=\sqrt{\frac{M_1}{M_2}}$$

$$\frac{T_2}{2_1}=\sqrt{\frac{M}{4M}}$$

$$T_2=1\text{sec}$$

42. (b)



Form junction law,

$$\frac{KA}{1}(T-T_1)+\frac{KA}{1}(T-T_2)+\frac{KA}{1}(T-T_3)$$

$$T=\frac{T_1+T_2+T_3}{3}$$

$$T=\frac{0+90+90}{3}=60^0C$$

43. (a) $evB=\frac{mv^2}{R}$

$$\Rightarrow v=\frac{e}{m}BR$$

Kinetic energy of photoelectrons

$$K=\frac{1}{2}mv^2=\frac{e^2B^2R^2}{2m}$$

$$k=2.97\times 10^{-15}J=18.6KeV$$

$$K = E_P - E(K)$$

$$BE = E_p - K = 24.8 - 18.6 = 6.2KeV$$

44. (b)Given that amount of heat given is equal to the decrease in internal energy,

$$\frac{R}{\gamma-1} + \frac{R}{1-x} = -\frac{R}{\gamma-1}$$

$$\frac{R}{\gamma-1} + \frac{R}{1-\frac{6}{5}} = \frac{-R}{\gamma-1}$$

$$\frac{5}{2} = \frac{1}{\gamma-1}$$

$$\Rightarrow \gamma - 1 = \frac{2}{5}$$

$$\Rightarrow \gamma = \frac{7}{5}$$

The gas may be diatomic or polyatomic linear.

45. (b)Electric potential

$$V = \left(\frac{1000}{x} + \frac{1500}{x^2} + \frac{500}{x^3}\right)$$

Electric field

$$E = -\frac{dv}{dt} = \left(\frac{1000}{x^2} + \frac{(2)500}{x^3} + \frac{(3)500}{x^4}\right)\hat{i}$$

At x = 1

$$E = 5500\hat{i}\,Vm^{-1}$$

46. (b) $f_{app} = f_0\left(\frac{v+v_0}{v}\right)$

$$\frac{f_{app} - f_0}{f_0} = \frac{v_0}{v} = \frac{\frac{v}{5}}{v} = \frac{1}{5} = 20\%$$

47. (c) $\sin\theta = \frac{\lambda}{a}$

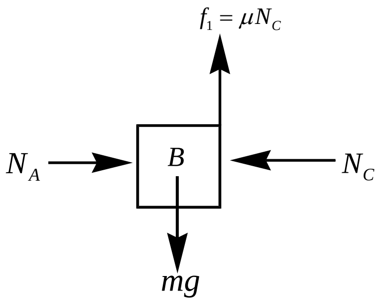
$$\Rightarrow \sin 30^0 = \frac{6500}{a}A^0$$

$$\therefore \frac{1}{2} = \frac{6500}{a}A^0$$

$$\therefore\ \therefore a = 2\times 6500A^0 = 2\times 6500\times 10^{-10}m$$

$$\therefore\ a = 1.3\times 10^{-6}m$$

48. . (b)



$$N_C = \frac{F}{5m}(2m) = \frac{2F}{5}$$

Since block B is not falling therefore.

$$\mu N_C = mg$$

$$\mu\left(\frac{25}{5}\right) = mg$$

$$F = \left(\frac{5}{2\mu}\right)mg$$

49. (d)The given equation can be written as

$$y = 4\sin\left(4\pi t - \frac{\pi x}{16}\right)$$

Wave velocity is given by

$$\Rightarrow v = \frac{Coefficient\ of\ t(\omega)}{Coefficient\ of\ x(K)}$$

$\Rightarrow v = \frac{4\pi}{\frac{\pi}{16}} = 64cm\,s^{-1}$ along + x direction.

50. (c)Current through resistors R_1 and R_3 in steady state is zero

Therefore current through R_2 is

$$i_2 = \frac{E}{R_2 + r} = \frac{5}{4+1} = 1A$$

Therefore charge on capacitor is $q = C\left(\frac{i_2R_2}{2}\right) = 6\mu C$

CHEMISTRY

1. $\frac{P^0 - P_S}{P^0} = \frac{n_s}{n_s + n_{sol}}\ P^0 - P_S = \frac{1}{1+\frac{1000}{18}}\times 760$

(c)

$$P^0 - P_s = 13.43mm$$

2. (d)X particle = $\frac{1}{8}\times 6 + \frac{1}{2}\times 6 = \frac{15}{4}$

Y Particle = 3, Z particle = 6

$X_{\frac{15}{4}}Y_3Z_6 = X_5Y_4Z_8$

3. (c) $PCl_5 \leftrightarrows PCl_3 + Cl_2$

$$x = \sqrt{\frac{kp}{P}} = \sqrt{\frac{0.202}{1.5}} = \sqrt{0.134} = 0.366$$

Volume percentage = $\frac{Mole\,of\,Cl_2}{Total\,moles} \times 100 = \frac{0.366}{1.366} \times 100 = 26.84\%$

4. (c) $Mn - [Ar]3d^5 4s^2$

$Mn^{+2} - 3d^5$ half filled 3d – orbital which requires higher ionization energy.

5. (c)Conceptual

6. (d) $K = Ae^{-Eu/RT}$ $\quad -e^{-Eu/RT} = \frac{0.01}{100} \Rightarrow \frac{Ea}{RT}$

$= 2.303 \log 10^{-4}$

$Ea = 2.303 \times 4 \times 400 = 30.6\,KJ/mol$

7. (c) $Na_2S_2O_3 + AgBr \rightarrow Na_3Ag(S_2O_3)_2 + NaBr$

8. (b) $NaCN + ZnS \longrightarrow Na_2[Zn(CN)_4]$

9. (b)

$\Delta H^0 = H_P - H_R = -110.5 + -241.8 + 393.5 = 41.2$

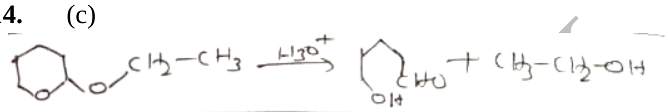
10. (b)Analgin

11. (c) $ROH + TsCl \rightarrow ROTs$ Tosylate Ion $[TSO^-]$ is good leaving hence substituted by – SN through SN^2 mechanism.

12. (b)Chalcopyrite is a natural sulphide of Cu and $Fe\left(CuFe52\right)$.

13. (c) : Magnetite: Fe_3O_4

14. (c)



15. (a) $m = \frac{17 \times 1000}{1000 \times d - 17 \times M.W}$

$$m = \frac{10^{-2} \times 1000}{1000 \times 1.1 - 10^{-2} \times 106}$$

$$m = \frac{10}{1099.4} = 9 \times 10^{-3}$$

16. (b) $CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - CH_2 - CH_3 \xrightarrow[H_3O^+]{CH_3MgBr}$

$$CH_3 - CH_2 - \underset{CH_3}{\underset{|}{\overset{OH}{\overset{|}{C}}}} - CH_2 - CH_3$$

17. (c) $NaBH_4$ is mild reducing agent which reduces carbonyl into alcohol but do not reduce ester.

18. (d) XeF_2 square planar shape. It is non polar.

19. (d)For a sealed regid container m and v remains constant hence the density remains same even if temperature changes.

20. (a) $Cl -$ carbon of $D(+)$ glucose is called anomeric carbon.

21. (b) $PbO_2 + H_2O_2$ convert Pb^{+4} into more stable Pb^{+2} liberating oxygen.

22. (d)

$H_3BO_3 \xrightarrow{100^0 C} HBO_2 \xrightarrow{160^0 C} H_4B_2O_7 \xrightarrow[7250^0 C]{\Delta} B_2O_3 +$

23. (a)In the presence of peroxy acid, among $C=C$ and $C\equiv C$, it is alkene selectely undergo hydroxylation forming diol.

24. (b) : $CH_3CH_2NC \xrightarrow[Ni/Pt]{H_2} CH_3CH_2NHCH_3$

25. (b)

$$PhCHO + CH_3CHO \xrightarrow{OH^-} Ph-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2CHO$$

$$2CH_3CHO \xrightarrow{OH^-} CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CHO$$

26. (a)Chlorides of Ag are insoluble, while chlorides Ba and Ca imparts colour to Bunsen flame.

27. (c)This is an example of peptization.

28. (c)

$$\overset{C}{\frac{20}{12}}\ \overset{N}{\frac{46.66}{14}}\ \overset{H}{\frac{6.66}{1}}\ \overset{O}{\frac{26.68}{16}}\quad 1:2:4:1\ CN_2H_4O$$

29. (a) $\%\alpha = 105.7x - 5220 - 52x = 8220$

$$x = \frac{2800}{98.5} = 28.4$$

30. (d)

$$CH_3CH_2NH_2 + CHCl_3 + 3KOH \rightarrow C_2H_5NC + 3KCl + 3H_2O$$

31. (b) Fe^{+2} ions $= x$; $Fe^{+3}\ Ions = \frac{2x}{3}$;

$$Fe^{+2} : Fe^{+3} = 3:2$$

32. (d)Terbium(Z=65)

33. (b)

$$\frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} \qquad \lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1 + \lambda_2}$$

34. (c)

$$\Delta S = nR\ln\left(\frac{P1}{P2}\right)$$

35. (a) $4r = \sqrt{2}a$

$$r = \frac{\sqrt{2a}}{4} = \frac{1.414\times 5.14}{4} = 1.815A^0$$

36. (c)

$$\lambda = \frac{h}{\sqrt{2mK.E.}}$$

$$h = \frac{6.6\times 10^{-34}}{\sqrt{2\times 9.1\times 10^{-31}\times 13.6\times 1.6\times 10^{-19}}}$$

$\lambda = 3.34\times 10^{-10}\,m$ Energy absorbed by an atom $= 2\times 13.6$

Energy converted in escape $= 13.6\,ey$

Energy converted into K.E. $= 13.6\times 1.6\times 10^{-19}\,J$

37. (b) $Cl_2 + 2H_2O \rightarrow 2ClO^- + 4H^+ + 2e^-$

$$E^0 = -1.61V$$

$$ClO^- + 2H_2O \rightarrow ClO_3^- + 4H^+ + 4e^-$$

$$E^0 = -0.50V$$

38. (c) : Only $-CH_3$ group is electron donating group hence it increases the electron density on nitrogen making it most basic.

39. (a) $-Cl > -OCOR > -OR > -NH_2$ (Leaving group order)

40. (c) $\Delta T_f = iK_f m$

$$0.0054 = i\times 1.8\times .001 \qquad i = 3$$

41. (c)

$$\Lambda m = \frac{1000K}{C} = 3.75 \qquad \alpha = \frac{\Lambda m}{\Lambda_m^{\alpha}} = \frac{3.5}{250} = 0.015$$

$$K_a = C\alpha^2 = 0.1(0.015)^2 = 2.25\times 10^{-5}$$

42. (c)No carbo cation can form at and bridge head carbon.

43. (c) $C_6H_5COOC_2H_5$ esters cannot undergo Claisen – self condensation as there is no $\alpha-$hydrogen.

44. (a)It is expulsion of a liquid from a gel, which hardens the gel.

45. (d) N_2O is neutral oxide of nitrogen also known as laughing gas.

46. (a) : Primary amines react with benzoyl chloride to give benzamides and the reaction is known as benzoylation.

$$\underset{\text{Methana mine}}{CH_3NH_2}+\underset{\text{Benzoylchloride}}{C_6H_5COCl}\longrightarrow\underset{\text{N-Methylbenzamide}}{CH_3NHCOC_6H_5}+HCl$$

47. (c)I) $CH_3-\ddot{\underset{..}{O}}\overset{\oplus}{C}H_2$ more stable than $\overset{\oplus}{C}H_2$ because of +M effect of $CH_3\ddot{\underset{..}{O}}-$

II) $Me_3\overset{\oplus}{C}H$ is more stable than $CH_3-CH_2-\overset{\oplus}{C}H_2$

III) +ve charge delocalized in $CH_2=CH-\overset{\oplus}{C}H_2$ so more stable than $CH_3-CH_2-\overset{\oplus}{C}H_2$

48. (b) : In blast furnace, Fe_2O_3 is reduced to Fe by CO.

$$Fe_2O_3+3CO\rightarrow 2Fe+3CO_2\uparrow$$

49. (b) $\left[OH^-\right]Ion=10^{-10}+10^{-7}$

$$pOH=-\log\left[10^{-10}+10^{-7}\right]\qquad\left(10^{-10}\ll 10^{-7}\right)$$

$$pOH=7$$

pH=7

50. (c) $\Delta H=\Delta E+P\Delta V$

$$\Delta H=30+\left(4\times5-2\times3\right)=44\,L-atm$$

BIOLOGY

1. (a)

2. (c)

3. (c)

4. (b)

5. C

6. (d)

7. (b)

8. (a)

9. (c)

10. (a)

11. (c)

12. D

13. (*a*) ATPase has two parts, i.e. F0 and F1. F0 part has channels through which the diffusion of protons takes place.

14. (a)

15. (b)

16. (a)

17. (d)

18. (c)

19. (a)

20. (b)

21. (c)

22. B

23. (d)

24. B

25. (a)

26. (d)

27. (a)

28. (c)

29. (a)

30. B

31. (*d*) Zygotic meiosis is represented in the haplontic life cycle of many algae including *Chlamydomonas*. In such a life cycle, all cells are haploid except zygote. This is because meiosis occurs in the zygote itself, resulting into four haploid cells that give rise to haploid plants. Other options like *Fucus* exhibit diplontic cycle, while *Marchantia* and *Funaria* both exhibit haplo-iplontic cycle.

32. (d)

33. (d)

34. (c)

35. (a)
36. (b)
37. C
38. (b)
39. (b)
40. (b)
41. (b)
42. (c)
43. (a)
44. (d)
45. (d)
46. (b)
47. (b)
48. (*c*) ABA is a stress hormone and induces seed dormancy in plants. On the other hand, gibberellic acid breaks seed dormancy and induces seed germination. So both act opposite to each other, i.e. are antagonistic to each other. Thus, ABA is antagonistic to gibberellic acid.
49. (b)
50. (c)

01. (a)
02. (a)
03. (c)
04. (a)
05. (b)
06. (c)
07. (d)
08. (c)
09. (b)
10. (b)
11. (c)
12. (c)
13. (d)
14. (a)
15. (d)
16. (d)
17. (d)
18. (b)
19. (c)
20. (a)
21. (a)
22. (d)
23. (b)
24. (a)
25. (c)
26. (a)
27. (a)
28. (d)
29. (d)
30. (b)
31. (a)
32. (b)
33. (c)
34. (b)
35. (b)
36. (c)
37. (b)
38. (d)
39. (d)
40. (d)
41. (b)
42. (d)
43. (a)
44. (a)
45. (d)
46. (a)

47. (b)

48. (c)

49. (a)
50. (d)