VMC MEDICAL

[Chemistry]

51. (3)

H–C–C–H (ethane: each C bearing two H)	one σ bond between C – C	A – III
$H_2C = CH_2$	1 σ and 1 π bond between C – C	B – IV
$C \overset{\pi}{\underset{\pi}{\equiv}} C$ Two π bond.		C – II
$HC \overset{\pi}{\underset{\pi}{\equiv}} \sigma CH$	one σ and two π bond between	D – I

A – III, B – IV, C – II, D – I

52. (2)

$K_H \uparrow$ solubility $\downarrow$

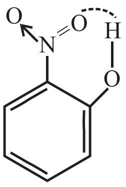
B > C > A

53. (1)

B.P increases with increases in molecular mass but highest B.P of H_2O due to H–Bonding.

54. (1)

O–Nitrophenol contains Intramolecular hydrogen bonding



55. (1)

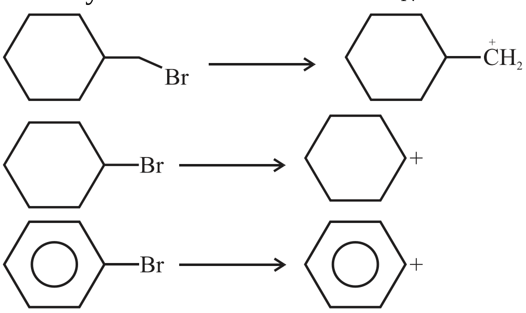
On increasing branching, decrease in surface area of alkane thus decrease in boiling point

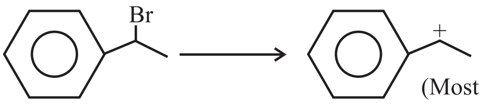
$$CH_3-CH_2-CH_2-CH_2-CH_3 > CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3 > CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$$

n – Pentane　　isopentane　　neopentane

56. (4)

Stability of carbocation ↑rate of S_N1 ↑





(Most stable
due to resonance
and Hyper conjugation)

57. (4)

3° alcohol reacts fast with lucas reagent due to more stable carbocation intermediate

58. (2)

$NaOH + HCl \longrightarrow NaCl + H_2O$

$n_{NaOH} = \dfrac{1}{40} = 0.025$

$n_{HCl} = MV$

$= 0.75 \times 25 \times 10^{-3}$

$= 0.01875$

Remaining mole of NaOH $= 0.025 - 0.01875$

$= 0.00625$

Weight NaOH remaining $= 40 \times 0.00625$

$= 0.25$ g

$= 250$ mg

59. (2)

Li < Be > B < C < N

Li < B < Be < C < N

60. (4)

Check the carbocation directly without any rearrangement

3° Carbocation is most stable

61. (4)

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

62. (1)

Aniline does not undergo Fridel – Crafts alkylation reaction due to basic character of l.p of N of NH_2 with Lewis acid.

Only aliphatic primary amines can be prepared through Gabriel synthesis

63. (1)

Si < C < N < O < F

1.9 2.5 3 3.5 4

64. (1)

$1\,H_2\overset{-2}{O} \xrightarrow[2F]{} \overset{0}{O_2}$ A → II

$1\,\overset{+7}{Mn}O_4^- \xrightarrow[5F]{} Mn^{2+}$ B → IV

$1.5\,Ca \xrightarrow[3F]{} Ca^{+2}$ C – I

$1\,\overset{+2}{Fe}O \xrightarrow[1F]{} \overset{+3}{Fe_2}O_3$ D → III

A → II, B → IV, C → I, D → III

65. (1)

$[Co(NH_3)_5\ (NO_2)]Cl_2$ A → II

↑

ambidentate ligand shows linkage isomerism

$[Co(NH_3)_5\ (SO_4)]\ Br$ B → III

Different ions shows Ionisation Isomerism

$[Co(NH_3)_6]\ [Cr(CN)_6]$ C – IV

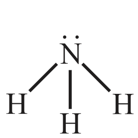
Different co-ordination sphere

$[Co(H_2O)_6]Cl_3$ D – I

↓

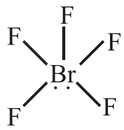
Hydrate (solvation)

66. (1)



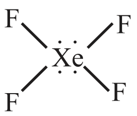
A – I

Trigonal Pyramidal



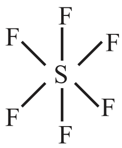
B – IV

Square Pyramidal



C – II

Square Planar



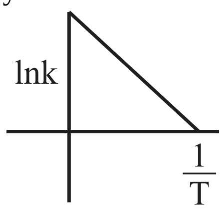
D – III

Octahedral

67. (4)

$\ln k = \ln A - \frac{Ea}{R} \times \frac{1}{T}$

$y = C - mx$



68. (1)

$$E = \frac{E_{1(H)} z^2}{n^2}$$

$$E_{1(H)} = \frac{En^2}{z^2}(\text{constant})$$

$$\left[\frac{En^2}{z^2}\right]_{He^+} = \left[\frac{En^2}{z^2}\right]_{Be^{3+}}$$

$$\frac{-x \times 1^2}{2^2} = \frac{E \times 2^2}{4^2}$$

$E = -x$ J.

69. (3)

Entropy increases

(1) with increase in Temp

(2) with change of physical state from
Solid → Liquid → Gas

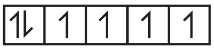
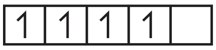
(3) with increase in gaseous particle

70. (4)
Precipitation reactions are not Redox reaction because there is no change in oxidation state
$BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + 2NaCl$

71. (2)

$m_l \rightarrow$ orientation of orbital	$A \rightarrow III$
$m_s \rightarrow$ spin of electron	$B \rightarrow IV$
$l \rightarrow$ shape of orbital	$C \rightarrow I$
$n \rightarrow$ size of orbital	$D \rightarrow II$

$A \rightarrow III, B \rightarrow IV, C \rightarrow I, D \rightarrow II$

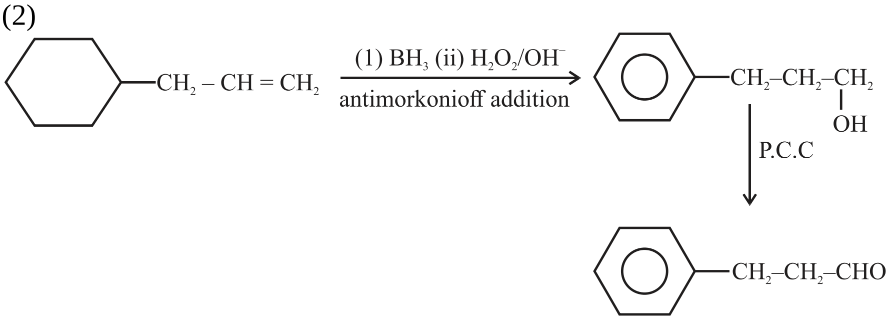
72. (1)
A $_{22}T_1^{+3}$ d^1 $_{26}Fe^{+2}$ d^6 
d^4
B $_{24}Cr^{+2}$  E $_{21}SC^{+3}$ d^0
C $_{25}Mn^{+2}$ d^5
B and D contain 4 unpaired electron

73. (1)
(1) 4 mol He = $4 \times 6.02 \times 10^{23}$ He atom (maximum)
(2) 4 u of He = 1 He atom
(3) 4 g of He = 6.02×10^{23} He atom
(4) 2.271098 L of He at STP $= \frac{2.27}{22.7} \times 6.02 \times 10^{23}$ He atom

74. (4)
P_0 is radioactive

75. (3)
$Mn^{+3} \longrightarrow Mn^{+2}$
d^4 $\quad$ d^5
(More stable)

76. (3)
Glucose does not react with $\underset{(E)}{NaHSO_3}$ and $\underset{(B)}{\text{Schiff}}$'s reagent

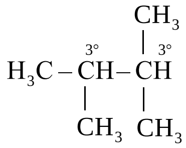
77. (2)


PCC is mild oxidising agent and oxidise primary alcohol into aldehyde.

78. (1)
If $\Delta n \neq O$ than $k_p \neq k_c$
(1) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ $\quad \Delta n = 2 - 1 = 1$
(2) $H_{2(g)} + I_{2(g)} \rightleftharpoons 2\,HI_{(g)}$ $\quad \Delta n = 2 - 2 = 0$
(3) $CO_{(g)} + H_2O(g) \rightleftharpoons CO_{2(g)} + H_{2(g)}$ $\quad \Delta n = 2 - 2 = 0$
(4) $2BrCl_{(g)} \rightleftharpoons Br_{2(g)} + Cl_{2(g)}$ $\quad \Delta n = 2 - 2 = 0$

79. (3)

C_6H_{14}



2, 3 – dimethyl butane

80. (1)

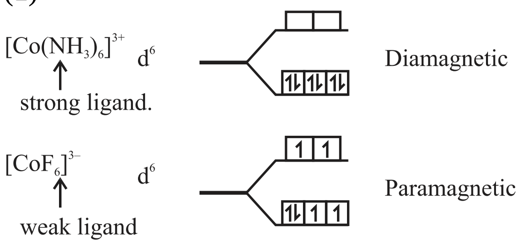
Fehling solution 'A' is aquous copper sulphate.

81. (4)

Isothermal process $\rightarrow$ Carried out at constant temperature	A – II
Isochoric process $\rightarrow$ Carried out at constant volume	B – III
Isobaric process $\rightarrow$ Carried out at constant pressure	C – IV
Adiabatic process $\rightarrow$ No heat exchange	D – I

A – II, B – III, C – IV, D – I

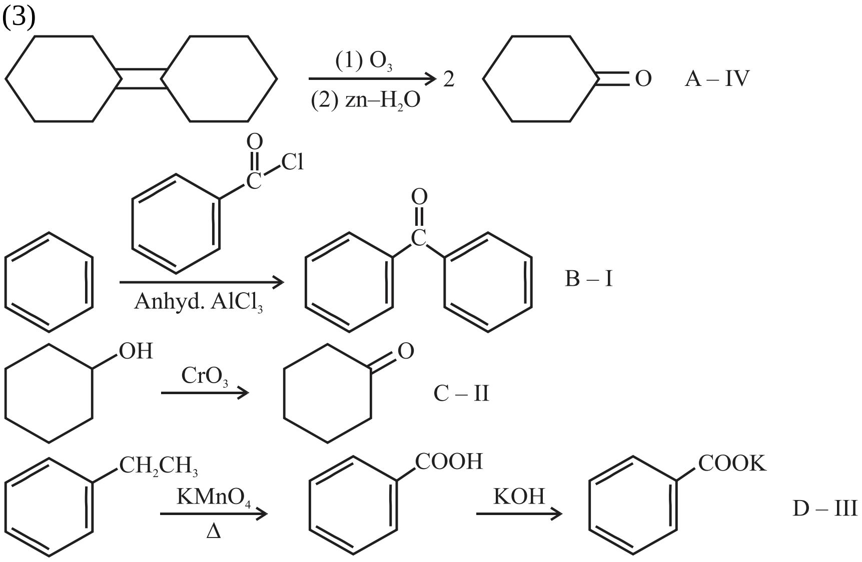
82. (1)



83. (2)

$$\text{Solid State} \xrightarrow{\text{Sublimation}} \text{Vapour state}$$

84. (3)



A – IV, B – I, C – II, D – III

85. (3)

$$2A \rightleftharpoons B + C$$

$$Q = \frac{[B][C]}{[A]^2} = \frac{2\times10^{-3}\times2\times10^{-3}}{\left(2\times10^{-3}\right)^2} = 1$$

$K = 4 \times 10^{-3}$

K < Q. So reaction proceed in backward direction

86. (1)

$_{58}Ce^{+4}$ $54e^{-}$ (Noble gas configuration)

$_{70}Yb^{+2}$ $4f^{14}$ (full filled orbital)

both are diamagnetic

87. (1)

$[Co(NH_3)_6]^{3+}$ has only one kind ligand (homoleptic)

$[Co(NH_3)_4Cl_2]^{+}$ has more than one kind ligand (Heteroleptic)

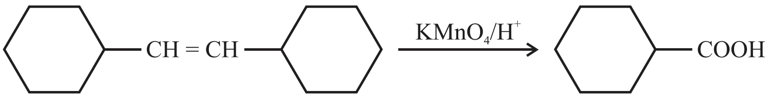
88. (2)

$$W = \frac{M' i t}{n F}$$

$$W = \frac{63 \times 9.6487 \times 100}{2 \times 96487}$$

$$W = \frac{63}{2} \times \frac{100}{10000} = 0.315\,g$$

89. (2)



90. (4)

$$3ROH + PCl_3 \longrightarrow 3RCl + \underset{(A)}{H_3PO_3}$$

$$ROH + PCl_5 \longrightarrow R-Cl + HCl + \underset{(B)}{POCl_3}$$

91. (1)

$$\log\frac{K_2}{K_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

$$\log 4 = \frac{E_a}{2.303 \times 8.314}\left[\frac{330 - 300}{330 \times 300}\right]$$

$$0.6021 = \frac{E_a}{2.303 \times 8.314} \times \frac{30}{330 \times 300}$$

$$E_a = \frac{0.6021 \times 2.303 \times 8.314 \times 330 \times 300}{30}$$

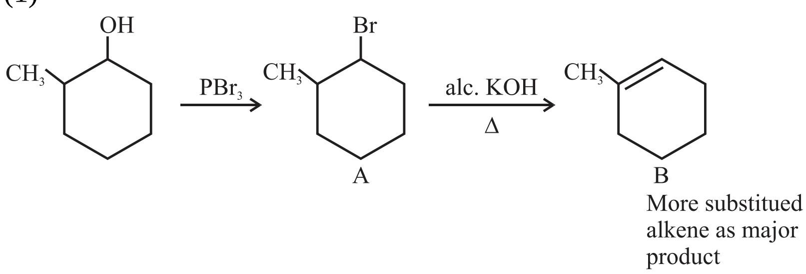
E_a = 38044 J

E_a = 38.04 kJ

92. (4)

Dilute sulphuric acid is added to prevent hydrolysis of Fe^{+2} ion during preparation of Mohr's salt solution

93. (1)



94. (1)

$\pi = CRT$

$\pi = (RT)\ C$

Slope = RT

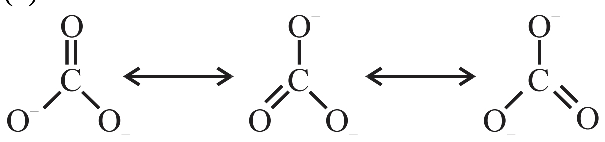
$25.73 = 0.083 \times T$

T = 310 K

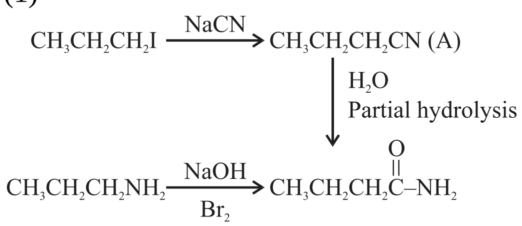
T = 310 – 273

= 37°C

95. (4)



96. (1)



Propylamine.

97. (1)

B Cu^{+2} (group II)

A Al^{+3} (group II)

D Co^{+2} (group IV)

C Ba^{+2} (group V)

E Mg^{+2} (group VI)

98. (2)

$$W = -2.303\ nRT\ \log\frac{P_{large}}{P_{small}}$$

$$W = -2.303 \times 1 \times 2 \times 298\ \log\frac{20}{10}$$

$W = -2.303 \times 1 \times 2 \times 298 \times 0.3010$

W = –413.14 Calories

99. (4)

$2NO(g) \rightleftharpoons N2(g) + O2(g)$

$$K = \frac{3\times10^{-3}\times4.2\times10^{-3}}{\left(2.8\times10^{-3}\right)^2} = 1.6$$

$$2NO \rightleftharpoons N_2 + O_2$$

$$1-\alpha \quad \frac{\alpha}{2} \quad \frac{\alpha}{2}$$

$$K = \frac{\frac{\alpha}{2}\times\frac{\alpha}{2}}{(1-\alpha)^2}$$

$\sqrt{K} = \frac{\alpha}{2(1-\alpha)}$

$2\sqrt{1.6} = \frac{\alpha}{1-\alpha}$

$2 \times 1.26 = \frac{\alpha}{1-\alpha}$

$2.52 = \frac{\alpha}{1-\alpha}$

$2.52 - 2.52\alpha = \alpha$

$2.52 = 3.52\alpha$

$\alpha = \frac{2.52}{3.52}$

$\alpha = 0.71$

100. (2)

$n_A : n_B : n_C$

$\frac{32}{64} : \frac{20}{40} : \frac{48}{32}$

1 : 1 : 3

ABC_3

VMC MEDICAL

[Physics]

1. (2)

Given, $(N + 1)\ V.S.D = N$ M.S.D [VSD = Vernier scale Division]
[MSD = Main scale division]

$$1\ V.S.D = \left(\frac{N}{N+1}\right) M.S.D$$

So, $VC = 1\ MSD - 1\ VSD$ [VC = Vernier constant]

$$= 1\ MSD - \frac{N}{N+1} MSD$$

$$= \left[\frac{N+1-N}{N+1}\right] MSD = \frac{1MSD}{N+1} = \frac{0.1mm}{N+1} = \frac{1}{100(N+1)} cm.$$

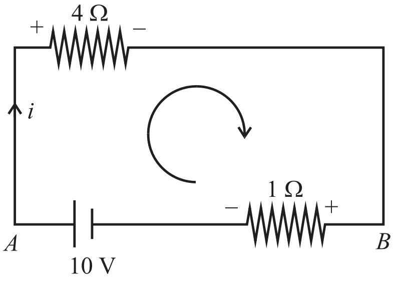
2. (3)

Central fringe will be white, because all wavelengths will constructively interfere here slightly below or above the central fringe, fringe will become colored.

3. (3)

From the given truth table it is clear that Y (output) = $\overline{B}$.

4. (3)



Apply KVL in loop $10 - 4i - i = 0$

$$i = \frac{10}{5} = 2A$$

$V_A - V_B = 10 - 1 \times 2 = 8V$

5. (4)

It is given that 20 oscillation in 5 sec. Time to complete one oscillation is equal to time period.

$$T = \frac{5}{20} = \frac{1}{4} S$$

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

T = Time period
I = Moment of inertia of loop
M = Magnetic moment
B = Magnetic field.

$$T^2 = 4\pi^2 \frac{I}{MB}$$

$M = 4\pi^2 \frac{I}{T^2 B}$

$M = \frac{4\pi^2 \times 9.8 \times 10^{-6}}{\left(\frac{1}{4}\right)^2 \times 0.049}$

$M = 1280\pi^2 \times 10^{-5}\, Am^2$

6. (2)

R = Resistance of each part

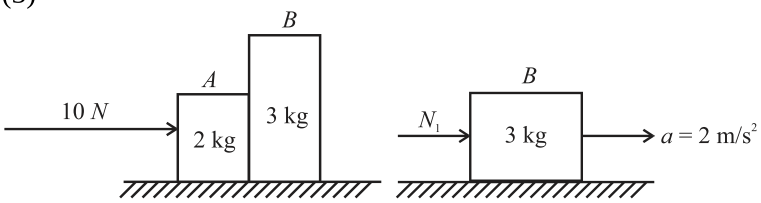
$= \frac{100}{10} = 10\Omega$

R_1 = 5 parts in series = 50Ω

R_2 = 5 parts in parallel = $\frac{10}{5} = 2\Omega$

Req = $R_1 + R_2$ = 50 + 2 = 52.Ω

7. (3)



Net force along horizontal direction

$10 = (2 + 3)a \quad \therefore\ a = 2\ ms^{-2}$

$N_1 = 3a$

$N_1 = 3 \times 2$

$N_1 = 6N$

8. (3)

Magnetic field at the centre due to each turn

$B = \frac{\mu_0 i}{2r}$

For 100 turns magnetic field will be

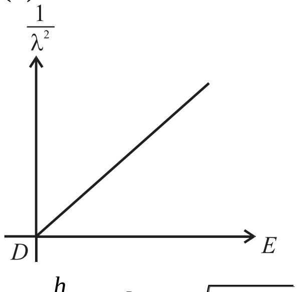
$B = \left(\frac{\mu_0 i}{2r}\right) \times 100$

$= \frac{4\pi \times 10^{-7} \times 7}{2 \times 10 \times 10^{-2}} \times 100 = 4.4 \times 10^{-3}\ T = 4.4\ mT$

9. (2)

$\frac{N_P}{N_S} = \frac{V_P}{V_S} \qquad \frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{2}{1}$

10. (4)



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

$\therefore \lambda = \dfrac{h}{\sqrt{2m K.E}} = \dfrac{h}{\sqrt{2mE}}$ $[K.E = E]$

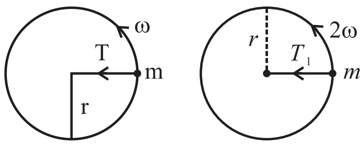
$\lambda^2 = \dfrac{h^2}{2mE}$ $\therefore E = \dfrac{h^2}{\lambda^2 \cdot 2m}$

$\Rightarrow \dfrac{1}{\lambda^2} = \left(\dfrac{2m}{h^2}\right)E$ ($\because$ slant straight line)

11. (3)

Atoms of each element are not stable

12. (2)

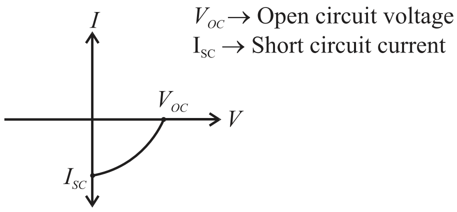


$T = m\omega^2 r$

$T_1 = m(2\omega)^2 r = 4m\omega^2 r$

$\therefore T_1 = 4T$

13. (1)



In reverse biased Pn Jn . diode current is limited due to concentration of the minority charge carrier on either side of the Junction.

14. (1)

Along the path bc,

$\Delta V = 0$

So work done in bc, $W = P\Delta V = 0$

15. (4)

The potential of point C & P is same. So potential difference between point C and P will be zero.

16. (1)

For Mid rod $I = mr^2/12$

($I = 2400g$ cm^2 & $m = 400g$)

So,

$r^2 = 12\ I/m = \dfrac{12 \times 2400}{400}$

$r = \sqrt{72}$ cm $= 8.48$ cm ≈ 8.5 cm

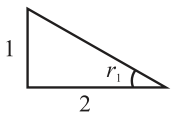
17. (4)

Varying velocity is due to changing direction in circular motion and centripetal acceleration also changes its direction in circular motion.

18. (2)
Theory

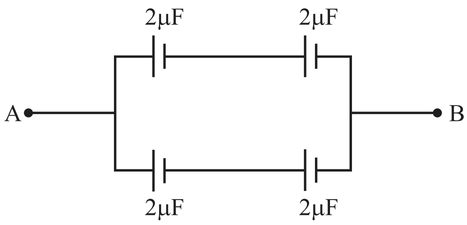
19. (1)
$S = 2t - 1$ $F = 5N$
So,
Velocity $V = \frac{ds}{dt} = 2$
And $P_{\text{instant}} = \overline{F} \cdot \overline{V} = 5 \times 2 = 10\ w$

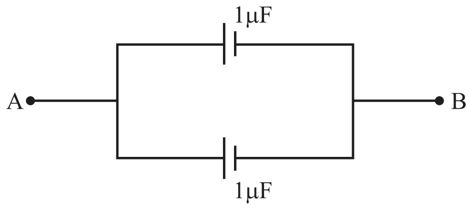
20. (2)
Given $A = 90°$, $i = 30°$
We know that $r_1 + r_2 = A$
$r_1 + r_2 = 90°$
$r_2 = 90° - r_1$
For incident ray
$M_1 \sin i = M_2 \sin r_1$
($M_1 = R.I.$ of air $M_2 = R.I.$ of prism)
$1 \times \sin 30° = M_{prism} \sin r_1$
$M_{prism} \sin r_1 = \frac{1}{2}$ ……..(i)
For emerging ray r_2 is critical angle
So $M_{prism} = \frac{1}{\sin r_2}$
$\Rightarrow M_{prism} = \frac{1}{\sin(90 - r_1)} = \frac{1}{\cos r_1}$ ……..(ii)
By (i) and (ii)
$\frac{\sin r_1}{\cos r_1} = \frac{1}{2}$
$\Rightarrow \tan r_1 = \frac{1}{2}$ $\sqrt{1^2 + 2^2} = \sqrt{5}$



So by triangle
$\sin r_1 = \frac{1}{\sqrt{5}}$
so by eq. (i)
$M_{prism} = \frac{\sqrt{5}}{2}$

21. (1)
This circuit is balanced W. S. B.
So we can consider it





So $C_{nct} = 1 + 1 = 2\mu F$

22. (1)

Strain and angle both are dimensionless

23. (1)

$$Y = \frac{\text{stress} \times l}{\Delta l}$$

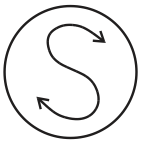
$$\Delta l = \frac{\text{stress} \times l}{Y}$$

$$= \frac{8 \times 10^{8}}{2 \times 10^{11}} \times 1 = 4 \times 10^{-3}\, m$$

= 4 mm

24. (1)

According to Lenz's Law



N is moving away from solenoid I So direction of current in coil will be clockwise to attraction it, so direction will be A to B and S is moving closer to solenoid II so direction will be a.c.w and D to C.

25. (4)

$$g_{earth} = \frac{GM_{earth}}{R_{earth}^2} = 9.8 \text{m/s}^2 \qquad \ldots\ldots\text{(i)}$$

$$g_{planet} = \frac{G\left(\frac{M_{earth}}{10}\right)}{\left(\frac{R_{earth}}{2}\right)^2}$$

$$= \frac{GM_{earth}}{(R_{earth})^2} \times 0.4 = g \times 0.4$$

$= 9.8 \times 0.4 = 3.92 \text{ m/s}^2$

26. (2)

(A) $\frac{1}{\lambda} = R\left(\frac{1}{n_F^2} - \frac{1}{n_i^2}\right) \quad R = 1.097 \times 10^{7}\ m^{-1}$

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{36}$$

$\lambda = 656nm \quad (III)$

(B) $\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3R}{16}$

$\lambda = 486.1$ nm (IV)

(C) $\dfrac{1}{\lambda} = R\left(\dfrac{1}{2^2} - \dfrac{1}{5^2}\right) = \dfrac{21R}{100}$

$\lambda = 434.1\ nm \quad (II)$

(D) $\dfrac{1}{\lambda} = R\left(\dfrac{1}{2^2} - \dfrac{1}{6^2}\right) = \dfrac{2R}{9}$

$\lambda = 410.2$ nm (I)

27. (4)

28. (1)

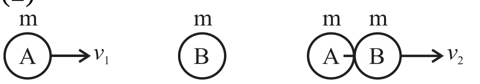
Diamagnetic $\Rightarrow 0 > \chi \geq -1$ $\quad$ A $\rightarrow$ II

Ferromagnetic $\Rightarrow \chi \gg 1$ $\quad$ B $\rightarrow$ III

Paramagnetic $\Rightarrow 0 < \chi < \varepsilon$ $\quad$ C $\rightarrow$ IV

Non-magnetic $\Rightarrow \chi = 0$ $\quad$ D $\rightarrow$ I

29. (2)



Inelastic collision

Using conservation of momentum,

$mv_1 = 2mv_2$

$\dfrac{V_1}{V_2} = 2$

30. (4)

$${}^{290}_{82}X \xrightarrow{\alpha} {}^{286}_{80}Y \xrightarrow{e^+} {}^{286}_{79}Z \xrightarrow{\beta^-} {}^{286}_{80}P \xrightarrow{e^-} {}^{286}_{81}Q$$

Atomic number of Q = 81

Mass number of Q = 286

31. (2)

Amplitude = 5m

Time period, $T = \dfrac{2\pi}{\omega}$

From equation, $\omega = \pi$; Hence, $T = \dfrac{2\pi}{\omega} = 2\,\text{sec}$

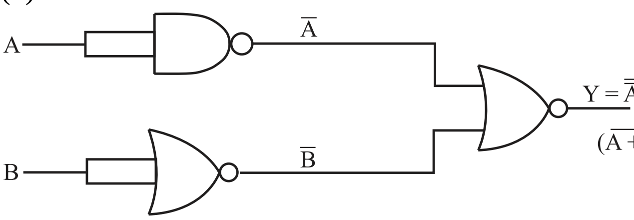
32. (1)

Excess force, $\quad F = S(2\pi R)$

$= \dfrac{0.07}{100} \times 2 \times \dfrac{22}{7} \times 4.5 \times 10^{-2}$

$= 0.0198$ N = 19.8 mN

33. (4)



$Y = \overline{\overline{A} + \overline{B}} = \overline{\overline{A}} \cdot \overline{\overline{B}} = A \cdot B$ (AND gate)

($\overline{A + B} = \overline{A} \cdot \overline{B}$, By De Morgan's Theorem)

34. (3)

$$V_{axial} = \pm\frac{KP}{r^2}$$

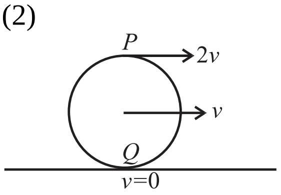
$$= \pm\frac{9\times10^9\times4\times10^{-6}}{2^2}$$

$= \pm\, 9 \times 10^3$ V

Assertion is true.

Reason is false.

35. (2)



$V_P > V_Q$

36. (2)

FACTUAL Displacement current has same magnitude as that of conduction current in current It also has same direction.

37. (4)

An accelerating charged particle produces an EM wave.

38. (2)

f_o = 140 cm

f_e = 5 cm

$$m = \frac{f_o}{f_e} = \frac{140\,\text{cm}}{5\,\text{cm}} = 28$$

39. (2)

P_1 = 1kW, P_2 = 2kW

First, when they are connected in series

$$\Rightarrow \frac{1}{peq} = \frac{1}{1\,\text{kW}} + \frac{1}{2\,\text{kW}}$$

$$Peq = \frac{1\,\text{kW}\times2\,\text{kW}}{1\,\text{kW}+2\,\text{kW}} = \frac{2}{3}\,\text{kW} \qquad \ldots\ldots(1)$$

$\Rightarrow$ When they are connected in parallel

Peq = 1kW + 2kW

= 3 kW …….(2)

Dividing (1) by (2)

$$\text{Ratio } = \frac{\frac{2}{3}\,\text{kW}}{3\,\text{kW}} = \frac{2}{9}$$

40. (4)

As know for ideal gas

$PV = nRT$

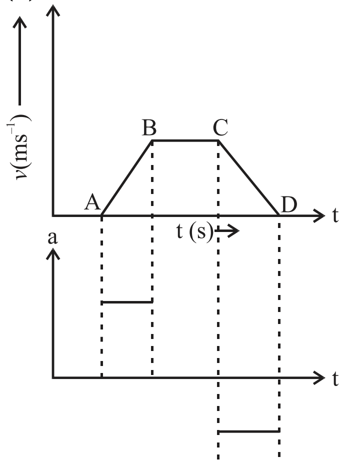
$$\frac{T}{V} = \frac{P}{nR}$$

$$\frac{T}{V}\,\alpha\, P$$

Now, as $\frac{T}{V}$ is slope in T–V graph, More slope means more P.

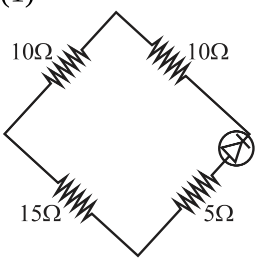
So, $P_1 > P_2 > P_3$

41. (3)



From A – B → Velocity is uniformly increasing hence acceleration is constant and positive
From B – C → Velocity is constant hence acceleration is zero.
From C – D → Velocity is uniformly decreasing hence acceleration is constant and negative.

42. (1)



Bridge balance is only possible in option (1) as in all other option, either the diode is reversed biased or diode is in parallel with 5Ω giving very less resistance compared to required for bridge balance.

43. (2)

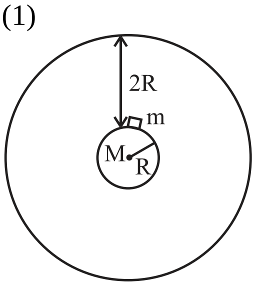
$T = 2\pi\sqrt{\frac{l}{g}}$

New time period, $T^1 = 2\pi\sqrt{\frac{\frac{l}{2}}{g}}$

$$= \frac{1}{\sqrt{2}} 2\pi\sqrt{\frac{l}{g}} = \frac{1}{\sqrt{2}}T$$

So $\frac{x}{2} = \frac{1}{\sqrt{2}} \Rightarrow x = \sqrt{2}$

44. (1)



On surface :- Energy of satellite $= -\frac{GMm}{R}$

In orbit: Total energy $= -\frac{GMm}{3R} + \frac{1}{2}mV_0^2$

$$= -\frac{GMm}{3R} + \frac{m}{2}\left[\sqrt{\frac{GM}{R+2R}}\right]^2$$

$$= -\frac{GMm}{3R} + \frac{1}{2}m.\frac{GM}{3R}$$

$$= -\frac{1}{2}\frac{GMm}{3R}$$

Energy difference $= \left[-\frac{1}{2}\frac{GMm}{3R}\right] - \left[-\frac{GMm}{R}\right]$

$$= \frac{GMm}{R}\left[-\frac{1}{6}+1\right] = \frac{5}{6}\frac{GMm}{R}$$

45. (2)

If sheet is magnetic, it would get magnetised and hence get attracted towards strong magnetic pole hence opposite force is required to hold the sheet.

Also, as eddy current is developed it will experience magnetic force so to move it with uniform velocity, force is required.

46. (2)

$$I_0 = \frac{V_0}{X_c}$$

$$= \frac{V.r.m.s.\sqrt{2}}{\frac{1}{\omega c}}$$

$= V.r.m.s.\sqrt{2}\ .\ \omega\ .\ c$

$= 210 \cdot \sqrt{2} \cdot 2\pi \cdot 50 \cdot 10 \times 10^{-6}$

$= 0.93$ A

47. (2)

$Y = 0.5 \times 10^{11}$ Nm^{-2}

$\alpha = 10^{-50}$ C^{-1}

$l = 1$m

$A = 10^{-3}$ m^2

$$Y = \frac{\frac{F}{A}}{\frac{\Delta l}{l}}$$

$$Y = \frac{F \cdot l}{A\Delta l}$$

$$F = \frac{Y \cdot A \cdot \Delta l}{l}$$

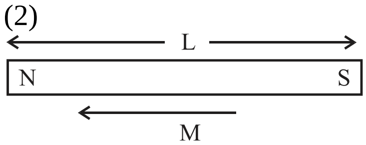
$= YA\alpha\Delta T$ $\quad (\because \Delta l = \alpha l\ \Delta T)$

$= 0.5 \times 10^{11} \times 10^{-5} \times 10^{-3} \times 100$

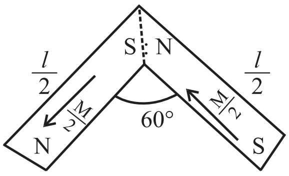
$= 0.5 \times 10^{11-8+2}$

$= 50 \times 10^3$ N

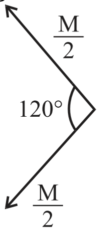
48. (2)



Now it is bent,



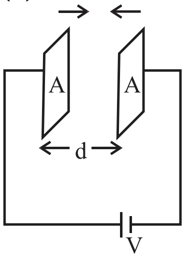
[As length is halved, magnetic moment is halved]



$$M^1 = \sqrt{\left(\frac{M}{2}\right)^2 + \left(\frac{M}{2}\right)^2 + 2.\frac{M}{2}.\frac{M}{2}.\cos 120°}$$

$$= \frac{M}{2}$$

49. (2)



$\Rightarrow C = \frac{A\varepsilon_0}{d}$

If battery is always connected, V remains same.

$\Rightarrow$ Now as d is decreased, C will increase (C)

So charge (= $C \cdot V$) increases (A).

$\Rightarrow$ Product of charge and voltage (= $q \cdot V$)

Increase as q increase (E)

50. (2)

F = $\alpha t^2 + \beta t$

$[\alpha] = \frac{[F]}{[t^2]} = \frac{[MLT^{-2}]}{[T^2]} = [MLT^{-4}]$

$[\beta] = \frac{[F]}{[t]} = [MLT^{-3}]$

So, $\frac{[\alpha t]}{[\beta]} = \frac{[MLT^{-4}][T]}{[MLT^{-3}]} = [M^\circ L^\circ T^\circ]$