07/12/2025

FS_Set-2 Online

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015, **Ph.**+91-1244168300

MM : 180

AIATS For Two Year JEE(Advanced)-2027 (XI Studying-P2)_Test-1A_Paper-2_Online

Time : 180 Min.

PHYSICS

Section-I

1. (D)

2. (B)

3. (D)

4. (B)

Section-II

5. (B,C)

6. (A,C)

7. (A,C)

Section-III

8. (18)

9. (2)

10. (4)

11. (10)

12. (5)

13. (62)

Section-IV

14. (16.00)

15. (30.00)

16. (20.00)

17. (01.00)

CHEMISTRY

Section-I

18. (A)

19. (C)

20. (B)

21. (D)

Section-II

22. (A,B,C)

23. (C,D)

24. (A,C)

Section-III

25. (15)

26. (10)

27. (2)

28. (13)

29. (4)

30. (6)

Section-IV

31. (50.00)

32. (04.00)

33. (05.00)

34. (06.00)

MATHEMATICS

Section-I

35. (B)

36. (D)

37. (C)

38. (A)

Section-II

39. (B,D)

40. (A,B)

41. (A,C)

Section-III

42. (3)

43. (20)

44. (1)

45. (16)

46. (24)

47. (2)

Section-IV

48. (02.00)

49. (02.00)

50. (00.50)

51. (01.00)

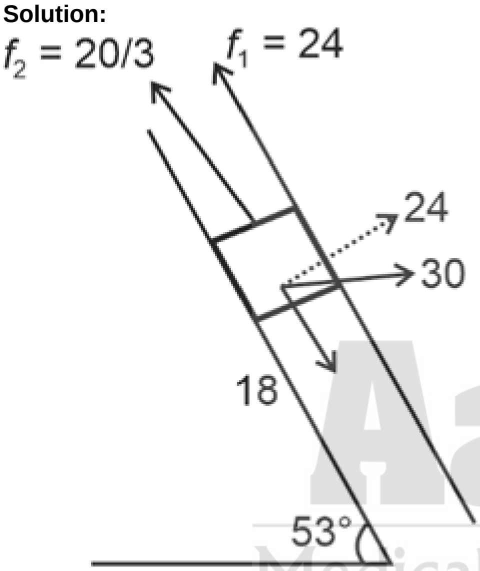
Hints and Solutions

PHYSICS

Section-I

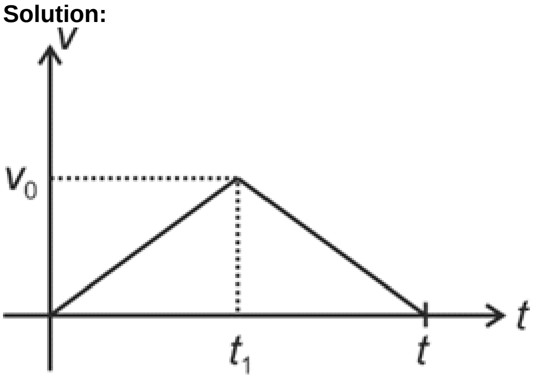
(1) **Answer :** (D)
Hint:
Velocity after two collision will be $e\left(-\overrightarrow{v}\right)$
Solution:
Velocity after two collision will be $e\left(-\overrightarrow{v}\right)$
Impulse = ΔP
Impulse $= 20\sqrt{3}$

(2) **Answer :** (B)
Hint:
Apply pseudo force on block
Solution:



$a_r = 0$
$a = 15$

(3) **Answer :** (D)
Hint:
Area under $v - t$ curve is displacement.
Solution:



$\frac{v_0}{t_1} = 5 \ \frac{v_0}{t-t_1} = 4$
$d = \frac{1}{2} \cdot t \times \left(\frac{5\times4}{5+4}\right)t$
$d = \frac{1}{2} \ \frac{5.4}{9} \ \cdot t^2 = 1000$
$t = 30$ sec

(4) **Answer :** (B)

Hint:

$I = \int dm\ r^2$

Solution:

$I = \frac{m(a^2+b^2)}{2}$

$= \frac{m}{2}\ \left(R^2 + 4R^2\right)$

$I = \frac{5}{2}\ mR^2$

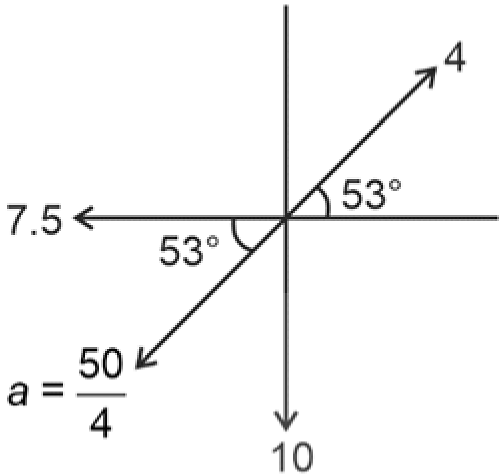
Section-II

(5) **Answer :** (B,C)

Hint:

Relative motion

Solution:



So path is straight line

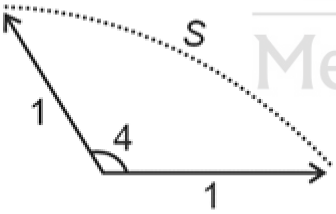
$v = 0$ at $t = \frac{100}{\frac{50}{4}}\ =\ 8\ \text{sec}$

(6) **Answer :** (A,C)

Hint:

$\ell = RQ$

Solution:



$\theta = \left(\frac{2}{1}\right)\ 2\ =\ 4$ rad

$S = \sqrt{1+1-2\cos 4}\ \ =\ 2\sin 2$

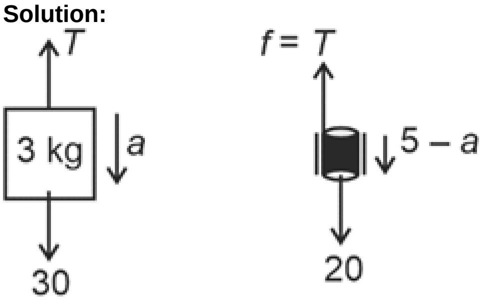
$a_{\text{avg}} = \frac{|\Delta V|}{t}\ = \frac{\sqrt{2^2+2^2-2\cdot 2\cdot 2\cos 4}}{2}\ \ =\ \frac{4\sin 2}{2} = 2\sin 2$

(7) **Answer :** (A,C)

Hint:

Tension equal to friction

Solution:



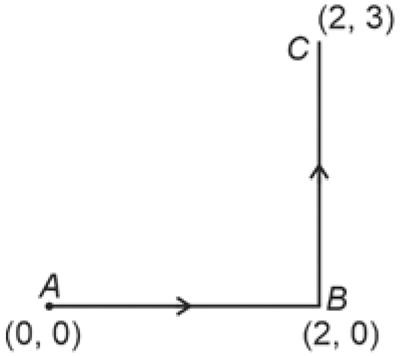
$30 - T = 3a$

$20 - T = 2\ (5 - a)$

$a = 4\ \text{m/s}^2$
$T = 18$ N

Section-III

(8) **Answer :** 18
Hint:
$w = \int \vec{F}\ ds$
Solution:



$w = w_{AB} + w_{BC}$

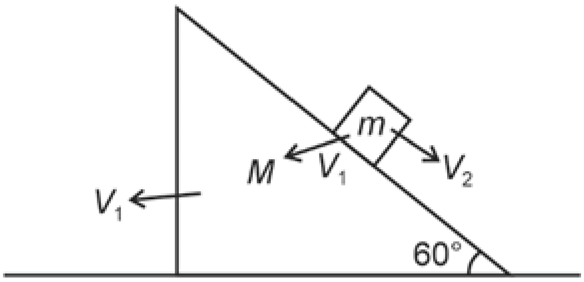
$$W = 2xy\ dx + \int_0^3 2^2\ \cdot\ y\ dy$$

$W = 18$

(9) **Answer :** 2
Hint:
$\frac{\Delta V}{V} = \frac{3\Delta h}{h}$
Solution:
$V = \frac{1}{3}\ \pi r^2 h$
$\tan\theta = \frac{r}{h}$
$V \propto h^3$
$\frac{\Delta V}{V} = \ \frac{3\Delta h}{h}$
$= 3 \times \frac{0.04}{6}\ \times\ 100$
$= 2\%$

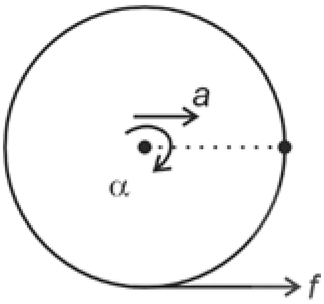
(10) **Answer :** 4
Hint:
Work energy theorem
Solution:
$x_i = 0\ \cdot\ 12 = \frac{3\mu mg}{k}$
at maximum speed $F_{\text{net}} = 0$
$x_f = \frac{\mu mg}{k}$
$\frac{1}{2}\ mV^2 = \frac{1}{2}\ k\left(\frac{3\mu mg}{k}\right)^2 - \frac{1}{2}\ k\left(\frac{\mu mg}{k}\right)^2 - \mu mg\ \left(\frac{2\mu mg}{k}\right)$
$V = 2\mu g\sqrt{\frac{m}{k}}$
$5V_0 = 4$ m/s

(11) **Answer :** 10
Hint:
Wedge constraint
Solution:



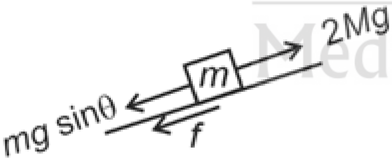
V_2 = 10 m/s
V_1 = 2 m/s
$V = \sqrt{2^2 + 10^2 + 2\ \cdot\ 2\ \cdot\ 10\ \cos(120^\circ)}$
$= \sqrt{84}\ =\ 2\sqrt{21}$

(12) **Answer :** 5
Hint:
$a = \alpha R$
Solution:



$f = 4ma$
$(mg - f)\ R = (3mr^2 + mr^2)\ \alpha$
$mg - f = 4ma$
$\alpha R = \frac{5}{4}$
$4a_0 = 5$

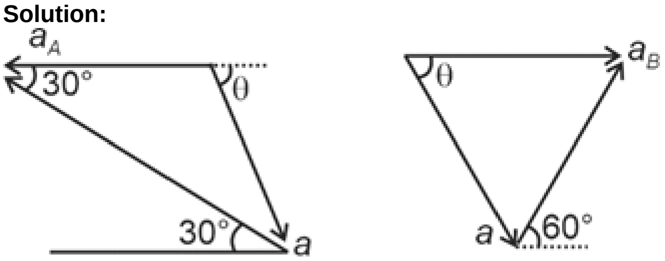
(13) **Answer :** 62
Hint:
Balance forces
Solution:



At equilibrium of $M \Rightarrow kx = Mg$
$mg\sin\theta + \mu mg\cos\theta = 1Mg$
$M = \frac{62}{5}$

Section-IV

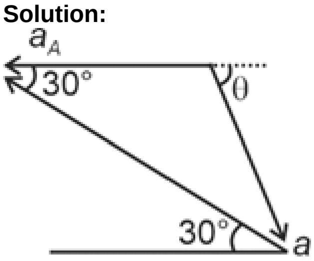
(14) **Answer :** 16.00
Hint:
Wedge constraint
Solution:

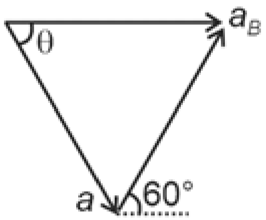


$a_A \sin30^\circ = a \sin(\theta - 30^\circ)$
$a_B \sin60^\circ = a \sin(\theta + 60^\circ)$
$a = a_A = 8\ m/s^2$

$\theta = 60°$
$\alpha = 30°$

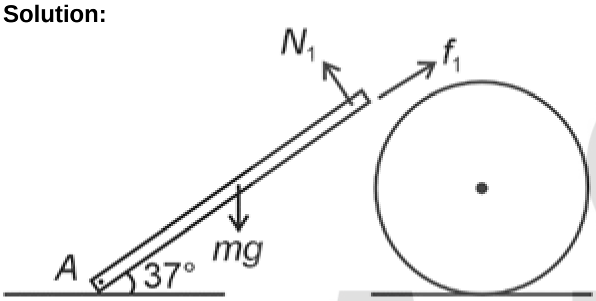
(15) **Answer :** 30.00
Hint:
Wedge constraint
Solution:



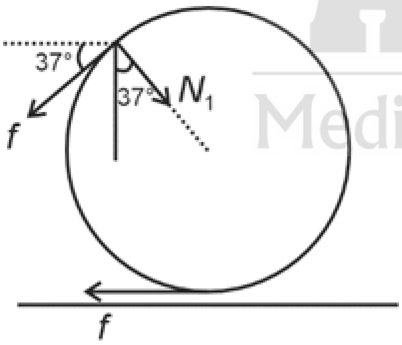


$a_A \sin 30° = a \sin(\theta - 30°)$
$a_B \sin 60° = a \sin(\theta + 60°)$
$a = a_A = 8\ \text{m/s}^2$
$\theta = 60°$
$\alpha = 30°$

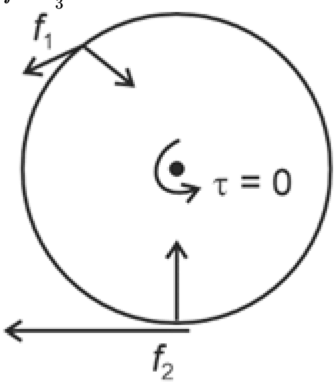
(16) **Answer :** 20.00
Hint:
Net torque on rod & sphere will zero.
Solution:



Torque on rod about point A = 0
$mg\ \frac{1}{2}\ \cdot\ \frac{4}{5}\ =\ N_1\ l$
$N_1 = 20$

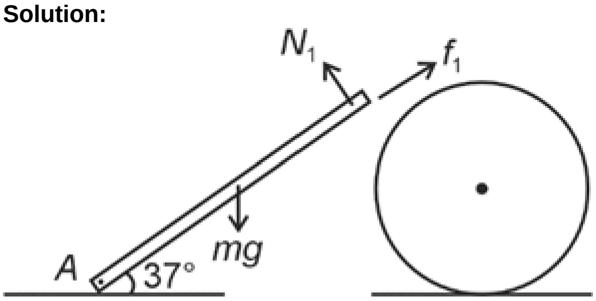


Net force on sphere in horizontal = 0
$f + f\ \cdot\ \frac{4}{5}\ =\ 20\ \cdot\ \frac{3}{5}$
$f = \frac{20}{3}$



$f_1 = f_2$

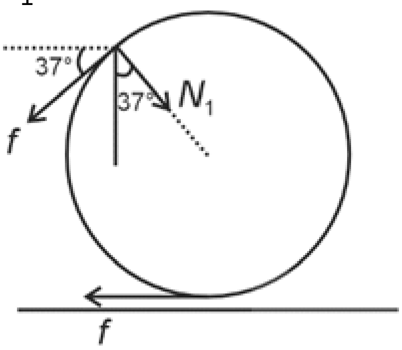
(17) **Answer :** 01.00
Hint:
Net torque on rod & sphere will zero.
Solution:



Torque on rod about point *A* = 0

$mg\ \frac{1}{2}\ \cdot\ \frac{4}{5}\ =\ N_1\ l$

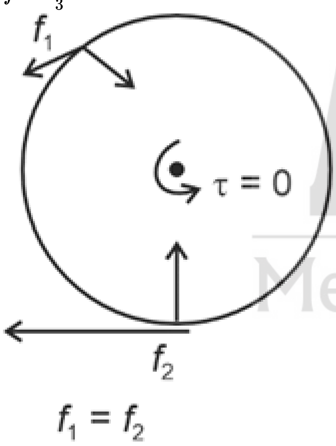
$N_1 = 20$



Net force on sphere in horizontal = 0

$f + f\ \cdot\ \frac{4}{5}\ =\ 20\ \cdot\ \frac{3}{5}$

$f = \frac{20}{3}$



CHEMISTRY

Section-I

(18) **Answer :** (A)
Hint:
r_n for H-atom = $a_0\ \frac{n^2}{z}$
Solution:

$r_2 = a_0 \frac{(2)^2}{1}$

$\Rightarrow\ x = 4a_0$

$\Rightarrow\ a_0 = \frac{x}{4}$

r_3 of Be^{3+} ion = $a_0\ \frac{9}{4}$

$= \frac{9}{4} \times \frac{x}{4}$

$= \frac{9x}{16}$

(19) **Answer :** (C)

Hint:

$MgCO_3$ and $CaCO_3$, both will produce CO_2 gas upon heating.

Solution:

$$\underset{\frac{x}{84}}{Mg\,CO_3} \xrightarrow{\Delta} MgO + \underset{\frac{x}{84}}{CO_2}$$

$$\underset{\frac{2-x}{100}}{Ca\,CO_3} \xrightarrow{\Delta} CaO + \underset{\frac{2-x}{100}}{CO_2}$$

Moles of CO_2 = $\frac{492.8}{22400} = 0.022\ mol$

$\frac{x}{84} + \frac{2-x}{100} = 0.022$

100x + 168 – 84x = 184.8

16x = 16.8

x = 1.05 g

mass of $CaCO_3$ = 2 – 1.05 = 0.95 g

% of $CaCO_3$ = $\frac{0.95}{2} \times 100$

= 47.5%

(20) **Answer :** (B)

Hint:

Metallic character increases down the group.

Solution:

Atomic size order ⇒ Ca < Sr < Ba < K

All other given orders are correct.

(21) **Answer :** (D)

Hint:

$$\%\, s = \frac{no.\ of\ s\ orbitals}{Total\ orbitals} \times 100$$

Solution:

XeO_3, NH_3, NF_3 and PF_3 has 1 lone pair on central atom and sp^3 hybridised having % s character is approximately 25.

SO_3, BF_3, $SnCl_2$ ⇒ sp^2 ⇒ % s ≈ 33%

XeO_4 ⇒ sp^3 but no lone pair on central atom.

Section-II

(22) **Answer :** (A,B,C)

Hint:

$$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$$

Solution:

$PV_m^3 - PbV_m^2 - RT\,V_m^2 + aV_m - ab = 0$

$V_m^3 - \left(b + \frac{RT}{P}\right)V_m^2 + \frac{a\,V_m}{P} - \frac{ab}{P} = 0$

Coefficient of V_m^3 is 1

Coefficient of V_m^2 is $-\left(b + \frac{RT}{P}\right)$

Coefficient of V_m is $\frac{a}{P}$

(23) **Answer :** (C,D)

Hint:

$$B_2 = \sigma 1s^2,\ \sigma * 1s^2,\ \sigma_2 s^2,\ \sigma * 2s^2,\ \pi_{2p}{}_x^1 = \pi_{2p}{}_y^1,\ \underbrace{\sigma 2p_z}_{LUMO}$$

Solution:

BO of N_2 = 3

$N_2^+ = 2.5$

BE ∝ BO

BE of $N_2 > N_2^+$

Li_2^+ and Li_2^- both have BO = $\frac{1}{2}$

Li ion having less no. of e^- in ABMO is more stable $Li_2^+ > Li_2^-$ (stability)

(24) **Answer :** (A,C)

Hint:
$CH_3Cl > CH_3F > CH_3Br > CH_3I$
Order of dipole moment
Solution:
BO ∝ B.E
(B.O)
$N_2 = 3$
$O_2^+ = 2.5$
$O_2 = 2$
$O_2^- = 1.5$
$BeCl_2 > MgCl_2 > CaCl_2 > BaCl_2$ (Covalent character)

Section-III

(25) **Answer :** 15
Hint:
$w = -P_{ext}(V_2 - V_1)$
Solution:
Number of moles of $H_2O = \frac{72}{18} = 4\ mol$
$2H_2O \rightarrow 2H_2 + O_2$
2 mol water form 3 mol gases
4 mol water will form 6 mol of gases
Volume of gases formed = $\frac{6 \times R \times 300\ m^3}{P}$
Work done = $-P_{ext}\,dV$
$= -P_{ext}\left(\frac{6 \times 8.3 \times 300}{P} - 0\right)$
= –14.94 kJ
Expansion work = 14.94 kJ

(26) **Answer :** 10
Hint:
$[H^+] = \sqrt{K_aC + K_w}$
Solution:
$= \sqrt{2 \times 10^{-12} \times 4 \times 10^{-4} + 10^{-14}}$
$= \sqrt{8 \times 10^{-16} + 10^{-14}}$
$= \sqrt{1.08 \times 10^{-14}}$
$= 1.04 \times 10^{-7}$
$= 10.4 \times 10^{-8} = x \times 10^{-8}$
x = 10.4

(27) **Answer :** 2
Hint:
$(K_{SP})_{PbSO_4} = [Pb^{2+}]\ [SO_4^{2-}]$
Solution:
$$\underset{0.75\ mmol}{Pb(NO_3)_2} + \underset{2.5\ mmol}{Na_2SO_4} \rightarrow PbSO_4 + 2NaNO_3$$
$-$ $1.75\ mmol$

Left $[SO_4^{2-}] = \frac{1.75\ mmol}{200\ mL} = 8.75 \times 10^{-3}\ M$
$K_{sp} = [Pb^{2+}]\ [SO_4^{2-}]$
$1.8 \times 10^{-8} = [Pb^{2+}] \times 8.75 \times 10^{-3}$
$[Pb^{2+}] = \frac{1.8 \times 10^{-8}}{8.75 \times 10^{-3}}$
$= 2.06 \times 10^{-6}$
x = 2.06

(28) **Answer :** 13
Hint:
$Kp = \frac{(X_B \cdot P_T)^2}{(X_A \cdot P_T)^3}$
Solution:

	$3A(g)$	$\rightleftharpoons$	$2B(g)$	
$At\ eqm.$	$1-\alpha$		$\frac{2}{3}\alpha$	$\alpha = 80\% = 0.8$
	$1-0.8$		$\frac{2}{3}\times 0.8$	

$0.2 \quad \frac{1.6}{3}$

$n_T = 0.2 + \frac{1.6}{3}$

$\frac{0.6+1.6}{3} = \frac{2.2}{3}$

$$K_p = \frac{\left(\frac{1.6\times 3}{3\times 2.2}\right)^2}{\left(\frac{0.2}{2.2}\times 3\right)^3 \times P}$$

$K_p = \frac{0.53}{0.02\ P} \quad \Rightarrow P = \frac{0.53}{0.02\times 2}$

= 13.25 bar

(29) Answer : 4

Hint:

• Electron gain enthalpy of N and Be are positive,

• 2^{nd} electron gain enthalpy of an element is positive

• Opposite of exothermic reaction is endothermic.

Solution:

$$\left.\begin{array}{ll} O^-(g) + e^- \rightarrow O^{2-}(g) & (\Delta H = +ve) \\ N(g) + e^- \rightarrow N^-(g) & (\Delta H = +ve) \\ O^-(g) \rightarrow O(g) + e^- & (\Delta H = +ve) \\ Be(g) + e^- \rightarrow Be^-(g) & (\Delta H = +ve) \end{array}\right\} \rightarrow Endothermic\ processes$$

(30) Answer : 6

Hint:

$BO = \frac{N_b - N_a}{2}$ (For diatomic molecule/ions)

For CO_3^{2-}

Solution:

$$B.O. = \frac{Total\ no.\ of\ bonds\ in\ any\ resonating\ structure}{no.\ of\ atoms\ involved\ in\ resonance\ other\ than\ central\ atom}$$

Molecule/Ions	Bond order
H_2	1
He_2^+	0.5
N_2	3
O_2^-	1.5
O_2^+	2.5
Br_2	1
CO_3^{2-}	1.33
NO^+	3
NO_2^-	1.5

Section-IV

(31) Answer : 50.00

Hint:

If SA neutralised with SB than 57 kJ energy evolved per equivalent of SB and SA.

Solution:

Let the heat capacity of insulated beaker is C and mass of aqueous content in exp-1 = (50 + 50) × 1 = 100 g

Total heat capacity = (C + 100 × 4.2) J/K

Heat released in Exp-1 = 0.025 × 57

= 1.425 kJ

⇒ 1.425 × 1000 = (C + 100 × 4.2)ΔT

⇒ 1425 = (C × 3.2 + 100 × 4.2 × 3.2)

⇒ 1425 = C × 3.2 + 1344

⇒ C × 3.2 = 1425 – 1344

$C = \frac{81}{3.2} = 25.3125\ J/K$

In 2nd experiment

n_{HCOOH} = 0.1 mol

n_{NaOH} = 0.05 mol

Total mass of aqueous content = 200 g

Total heat released =

25.3125 × 2.9 + 200 × 4.2 × 2.9

= 73.4 + 2436

= 2509.4 J = 2.51 kJ

$\Delta H_{new} = \frac{2.51}{0.05}\ kJ\ mol^{-1}$

= 50.2 kJ

≈ 50 kJ

$pH = pk_a + \log \frac{[HCOO^-]}{[HCOOH]}$

pH = pk_a

pH = –log(1.8 × 10^{-4})

pH = 4 – log1.8

= 3.74

3.74 = y + log0.5

y = 3.74 – log(0.5)

y = 3.74 + log2

= 3.74 + 0.3

= 4.04

(32) **Answer :** 04.00

Hint:

If SA neutralised with SB than 57 kJ energy evolved per equivalent of SB and SA.

Solution:

Let the heat capacity of insulated beaker is mass of aqueous content in exp-1 = (50 + 50) × 1 = 100 g

Total heat capacity = (C + 100 × 4.2) J/k

Heat released in Exp-1 = 0.025 × 57

= 1.425 kJ

⇒ 1.425 × 1000 = (C + 100 × 4.2)ΔT

⇒ 1425 = (C × 3.2 + 100 × 4.2 × 3.2)

⇒ 1425 = C × 3.2 + 1344

⇒ C × 3.2 = 1425 – 1344

$C = \frac{81}{3.2} = 25.3125\ J/k$

In 2nd experiment

n_{HCOOH} = 0.1 mol n_{NaOH} = 0.05 mol

Total mass of aqueous content = 200 g

Total heat released =

25.3125 × 2.9 + 200 × 4.2 × 2.9

= 73.4 + 2436

= 2509.4 J = 2.51 kJ

$\Delta H_{new} = \frac{2.51}{0.05}\ kJ\ mol^{-1}$

= 50.2 kJ

≈ 50 kJ

$pH = pk_a + \log \frac{[HCOO^-]}{[HCOOH]}$

pH = pk_a

pH = –log(1.8 × 10^{-4})

pH = 4 – log1.8

= 3.74

3.74 = y + log0.5

y = 3.74 – log(0.5)

y = 3.74 + log2

= 3.74 + 0.3

= 4.04

(33) **Answer :** 05.00

Hint:

For 2nd period order of IE

Li < B < Be < C < O < N < F

Solution:

A and B are metals and H is noble gas other all elements are non-metals. C, D, E, F and G are non-metals. D is carbon, atomic no. = 6

(34) **Answer :** 06.00
Hint:
For 2nd period order of IE
Li < B < Be < C < O < N < F
Solution:
A and B are metals and H is noble gas other all elements are non-metals. C, D, E, F and G are non-metals. D is carbon, atomic no. = 6

MATHEMATICS

Section-I

(35) **Answer :** (B)
Hint:
Vieta's formula
Solution:
$x^3 - 2x^2 - 1 = 0$
$\alpha^2 + \beta^2 + y^2$
$= (\alpha + \beta + y)^2 - 2(a\beta + \beta y + \alpha y)$
$= 4 - 0 = 4$

(36) **Answer :** (D)
Hint:
Transformation formula
Solution:
$$\frac{\tan\left(\frac{\pi}{4}+\alpha\right)}{\tan\left(\frac{\pi}{4}+\beta\right)} = \frac{5}{3}$$
$$\therefore \ \frac{\cos(\alpha+\beta)}{\sin(\alpha-\beta)} = \frac{8}{2} = 4$$
$\therefore \cos(\alpha + \beta) = 4\sin(\alpha - \beta)$

(37) **Answer :** (C)
Hint:
$$\log_2\left(\log_{\frac{1}{3}}(x)\right) < 1$$
Solution:
$$\log_{\frac{1}{2}}\left(\log_2\left(\log_{\frac{1}{3}}(x)\right)\right) > 0$$
$$\log_2\left(\log_{\frac{1}{3}}(x)\right) < 1$$
$$\log_{\frac{1}{3}}(x) < 2$$
$$x > \frac{1}{9} \ldots(1)$$
$$\log_2\left(\log_{\frac{1}{3}}(x)\right) > 0$$
$$\log_{\frac{1}{3}} x > 1$$
$$\Rightarrow x < \frac{1}{3} \ldots(2)$$
From (1) and (2)
$$x \in \left(\frac{1}{9}, \frac{1}{3}\right)$$

(38) **Answer :** (A)
Hint:
$$\Rightarrow |z_1|\,|z_2|\,|z_3|\left|\frac{9\bar{z}_3}{|z_3|^2} + \frac{4|\bar{z}_2|}{|z_2|^2} + \frac{\bar{z}_1}{|z_1|^2}\right| = 12$$
Solution:
$|9z_1z_2 + z_2z_3 + 4z_3z_1| = 12$
$$\Rightarrow |z_1|\,|z_2|\,|z_3|\left|\frac{9\bar{z}_3}{|z_3|^2} + \frac{4|\bar{z}_2|}{|z_2|^2} + \frac{\bar{z}_1}{|z_1|^2}\right| = 12$$
$$\Rightarrow 1 \times 2 \times 3\left|\overline{z_1 + z_2 + z_3}\right| = 12$$

$\Rightarrow |z_1 + z_2 + z_3| = 2$

Section-II

(39) **Answer :** (B,D)
Hint:
Make different cases
Solution:
M, A, T → 2
H, E, I, C, S → 1
Case I: All different
Number of ways = $^8C_4 \cdot 4!$
$= \frac{8!}{4!4!} \times 4! = 1680$
Case II: 2 same, 2 different
Number of ways = $^3C_1 \times {^7C_2} \times \frac{4!}{2!} = 756$
Case III: 2 same, 2 same
Number of ways = $^3C_2 \times \frac{4!}{2!2!} = 18$
Total number of words = 1680 + 756 + 18
= 2454

(40) **Answer :** (A,B)
Hint:
$a_n = a_1 + (n-1)d$
Solution:
$a_1 = 3$, $d = 6$, $T_1 = 1$
$a_n = a_1 + (n-1)d$
$= 3 + (n-1)6$
$T_{n+1} - T_n = a_n$
Put $n = 1$
$T_2 - T_1 = a_1$
$\Rightarrow T_2 = T_1 + a_1$
Put $n = 2$
$T_3 - T_2 = a_2$
$\Rightarrow T_3 = T_1 + a_1 + a_2$
$\vdots$
$T_{n+1} = T_1 + a_1 + a_2 + a_3 \ldots + a_n$
$= T_1 + \frac{n}{2}\ [2(3) + (n-1)6]$
$= T_1 + n(3 + 3n - 3)$
$= T_1 + 3n^2$
Put $n = 9$
$T_{10} = T_1 + 3(9)^2 = 1 + 243 = 244$
Put $n = 19$
$T_{20} = T_1 + 3(19)^2$
= 1 + 1083
= 1084

$$\sum_{k=1}^{20} T_k = 1 + \sum_{k=1}^{19} T_k$$

$$= 1 + \sum_{k=1}^{19}\left(1 + 3k^2\right)$$

$= 1 + (19) + \frac{3(19)(20)(39)}{6}$
= 1 + 19 + 7410
= 7430

$$\sum_{k=1}^{15} T_k = 1 + \sum_{k=1}^{14}\left(1 + 3k^2\right)$$

$= 1 + 1(14) + \frac{3(14)(15)(29)}{6}$
= 1 + 14 + 3045
= 3060

(41) **Answer :** (A,C)

Hint:
Taking log both sides,
$(x - 1) \log_{10}(x^2 - x + 1) < 0$
Solution:
$x^2 - x + 1 = \left(x - \frac{1}{2}\right)^2 + \frac{3}{4} > 0 \; \forall x \in R$
Given, $(x^2 - x + 1)^{x-1} < 1$
Taking log both sides,
$(x - 1) \log_{10}(x^2 - x + 1) < 0$
Case I: $x - 1 > 0$, $\log_{10}(x^2 - x + 1) < 0$
i.e., $x - 1 > 0$ and $0 < x < 1 \Rightarrow$ no solution
Case II: $x - 1 < 0$ and $\log_{10}(x^2 - x + 1) > 0$
$\Rightarrow x < 1$ and $x > 1$ or $x < 0$
$\Rightarrow x < 0$

Section-III

(42) **Answer :** 3
Hint:
Operations on set
Solution:
$B^C = \{1, 2, 8, 9, 10\}$
$A \cap B^C = \{1, 2\}$
$A \cup B = \{1, 2, 3, 4, 5, 6, 7\}$
$C - (A \cup B) = \{8\}$
$B \Delta C = \{2, 3, 5, 7, 8\}$
$(C - (A \cup B)) \cap (B \Delta C) = \{8\}$
$(A \cap B^C) \cup ((C - (A \cup B)) \cap (B \Delta C)) = \{1, 2, 8\}$
$\therefore$ Number of elements = 3

(43) **Answer :** 20
Hint:
$f(x) = x^3 - 3x$
Solution:
$\frac{f(x+y)}{x+y} - \frac{f(x-y)}{x-y} = 4xy = (x+y)^2 - (x-y)^2$
$\Rightarrow \frac{f(x+y)}{x+y} - (x+y)^2 = \frac{f(x-y)}{x-y} - (x-y)^2 = C$
$\Rightarrow \frac{f(x)}{x} - x^2 = C$
$\Rightarrow f(x) = x^3 + Cx$
$\because f(1) = -2$
$\Rightarrow C = -3$
$\therefore f(x) = x^3 - 3x$
$f(x) + f(-x) = 0$
$\therefore f(-5) + f(-4) + f(0) + f(2) + f(3) + f(4) + f(5)$
$= f(0) + f(2) + f(3)$
$= 0 + 8 - 6 + 27 - 9$
$= 20$

(44) **Answer :** 1
Hint:
Transformation formula
Solution:
$\sin^2 12° + \sin^2 21° + \sin^2 39° + \sin^2 48° - \sin^2 9° - \sin^2 18°$
$= \sin^2 12° + \sin^2 21° + (\sin^2 39° - \sin^2 9°) + (\sin^2 48° - \sin^2 18°)$
$= 1 - (\cos^2 12° - \sin^2 21°) + \sin 48° \sin 30° + \sin 66° \sin 30°$
$= 1 - \cos 33^\circ \cos 9^\circ + \frac{1}{2} \times 2 \times \sin 57^\circ \sin 9^\circ$
$= 1 - \cos 33° \cos 9° + \cos 33° \cos 9°$
$= 1$

(45) **Answer :** 16
Hint:
Replace x by $x - 3$ in given equation
$\Rightarrow x^3 - 10x^2 + 33x - 37 = 0$
Solution:

Let 3 + y = x ⇒ y = x – 3, then f(y) = 0
Replace x by x – 3 in given equation
⇒ $x^3 - 10x^2 + 33x - 37 = 0$
∴ 2a + b + c = 2(10) + 33 – 37
= 20 – 4
= 16

(46) **Answer :** 24
Hint:
Let x_1 be the number of times he took 1 step up the staircase
Let x_2 be the number of times he took 2 steps up the staircase.
$x_1 + 2x_2 = 11$
Solution:
Let x_1 be the number of times he took 1 step up the staircase
Let x_2 be the number of times he took 2 steps up the staircase.
$x_1 + 2x_2 = 11$

			No. of ways
$x_1 = 1$,	$x_2 = 5$	1, 2, 2, 2, 2, 2	$\frac{6!}{1!5!} = 6$
$x_1 = 3$,	$x_2 = 4$	1, 1, 1, 2, 2, 2, 2	$\frac{7!}{3!4!} = 35$
$x_1 = 5$,	$x_2 = 3$	1, 1, 1, 1, 1, 2, 2, 2	$\frac{8!}{3!5!} = 56$
$x_1 = 7$,	$x_2 = 2$	1, 1, 1, 1, 1, 1, 1, 2, 2	$\frac{9!}{2!7!} = 36$
$x_1 = 9$,	$x_2 = 1$		$\frac{10!}{9!1!} = 10$
$x_1 = 11$,	$x_2 = 0$		1

∴ P = 144
$\frac{P}{6} = 24$

(47) **Answer :** 2
Hint:
⇒ $(a + 2d)^2 = a(a + 6d)$
Solution:
Let r^{th}, $(r + 2)^{th}$ and $(r + 6)^{th}$ terms be a, $a + 2d$, $a + 6d$
⇒ $(a + 2d)^2 = a(a + 6d)$
⇒ $a = 2d$
Terms are (2d, 4d, 8d) so common ratio of G.P is 2

Section-IV

(48) **Answer :** 02.00
Hint:
$D \geq 0$
Solution:
$x + y = 4 - z$
$x^2 + y^2 = 6 - z^2$
∴ $2xy = (x + y)^2 - (x^2 + y^2) = (4 - z)^2 - (6 - z^2)$
$= 2z^2 - 8z + 10$
Quadratic equation whose roots are x & y is
$t^2 - (x + y)t + xy = 0$
$t^2 - (4 - z)t + z^2 - 4z + 5 = 0$
$D \geq 0$
$(4 - z)^2 - 4(z^2 - 4z + 5) \geq 0$
⇒ $(3z - 2)(z - 2) \leq 0$
$\Rightarrow z \in \left[\frac{2}{3}, 2\right]$
$p = \frac{2}{3}, q = 2$

(49) **Answer :** 02.00
Hint:
$f(2) \cdot f\left(\frac{2}{3}\right) < 0$

Solution:

For exactly one root to lie in $\left(\frac{2}{3},\ 2\right)$

$f(2)\ \cdot\ f\left(\frac{2}{3}\right)\ <\ 0$

$\Rightarrow a\ \in\ \left(\frac{1}{3},\ 3\right)$

∴ Number of integral values of *a* is 2

(50) **Answer :** 00.50
Hint:
Transformation formula
Solution:
$B = A = 15°$
$\sin(A+B) = \frac{1}{2}$
∴ $\alpha^2 = 3$

(51) **Answer :** 01.00
Hint:
Transformation formula
Solution:
$\cos(A - B) = 1$