SECTION A

Q. No.	(a)	(b)	(c)	(d)	Q. No.	(a)	(b)	(c)	(d)
1	☐	☐	☒	☐	16	☐	☐	☐	☒
2	☐	☐	☐	☒	17	☐	☒	☐	☐
3	☒	☐	☐	☐	18	☐	☒	☐	☐
4	☐	☐	☒	☐	19	☐	☒	☐	☐
5	☐	☐	☐	☒	20	☒	☐	☐	☐
6	☒	☐	☐	☐	21	☒	☐	☐	☐
7	☐	☐	☒	☐	22	☐	☐	☒	☐
8	☐	☒	☐	☐	23	☐	☒	☐	☐
9	☐	☐	☒	☐	24	☐	☐	☐	☒
10	☐	☒	☐	☐	25	☐	☒	☐	☐
11	☐	☐	☒	☐	26	☒	☐	☐	☐
12	☐	☐	☒	☐	27	☒	☐	☐	☐
13	☐	☐	☐	☒	28	☐	☐	☐	☒
14	☐	☐	☒	☐	29	☐	☐	☒	☐
15	☐	☐	☒	☐	30	☒	☐	☐	☐

SECTION B

Question 31

A)

PD of 1 V, gains 2 eV therefore charge of ion is -2 C

The number of electrons in the ion = X

Then the number of neutrons will be X + 25 X/ 100 = 1.25X

The number of electrons in the neutral atom = X-2

 The number of protons in the neutral atom = X -2

Mass number = No. of Protons   + No. of neutrons

79 = X-2 + 1.25X

2.25 X = 81

X = 81 / 2.25 = 36

Number of protons = 36 – 2 = 34 Hence the element is Se Symbol of Ion is Se^{-2}

B)

A = Ca   B= $CaOCl_2$ Y= $Ca(OH)_2$ Z= $CaSO_4$

Reactions: $2Ca + O_2 \rightarrow 2CaO$

$CaO + H_2O \rightarrow Ca(OH)_2$

$Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$
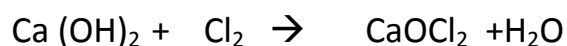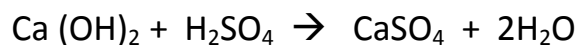
OR $2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(ClO)_2 + CaCl_2 + 2H_2O$

Question 32

X axis 1 cm = 5 cm (of u)
Y axis 1 cm = 20 cm (of v)

Observation table

u cm	0	-5	-7.5	-10	-12	-15	-18	-20	-22.5	-24	-25	-45	-60	-75	-90
v cm	0	6	10	15	20	30	45	60	90	120	150	-90	-60	-50	-45
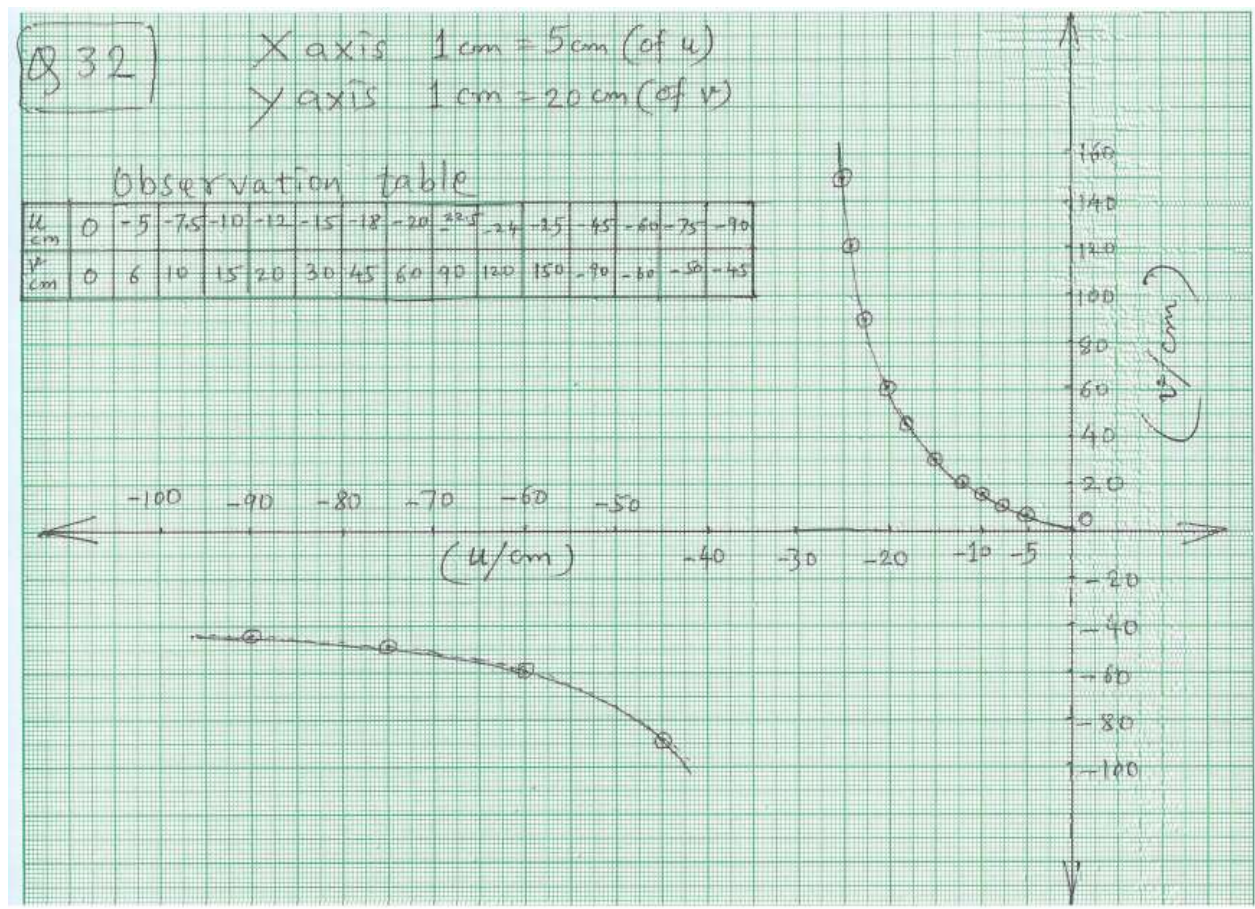
Question 33

I. Weight of glucose given = 10 g

180 g glucose refers to 1 mole

10g of glucose will be: 10/180 = 0.0555 moles

II. 1 molecule of glucose forms 2 molecules of pyruvic acid

All the glucose thus will produce 0.0555x2 = 0.111 moles of pyruvic acid

III. One molecule of pyruvic acid forms 1 molecule of lactic acid

Hence all lactic produced from the 25% of the pyruvic acid will be: 0.111/4 = 0.02775 moles

IV. 1 molecule of pyruvic acid gives 3 molecules of CO2

Hence moles of CO_2 produced from this pyruvic acid will be: 0.111x3 = 0.333 moles

V. i) cytoplasm, ii) cytoplasm, iii) mitochondria

Question 34

i)
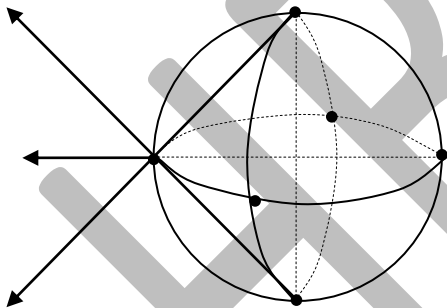
ii) $F_e = \dfrac{1}{4\pi\varepsilon_0}q^2\left(4 \times \dfrac{1}{\sqrt{2}} \times \dfrac{1}{2r^2} + \dfrac{1}{(2r)^2}\right) = \dfrac{1}{4\pi\varepsilon_0}\left(\sqrt{2} + \dfrac{1}{4}\right)\left(\dfrac{e^2}{r^2}\right)$ .... r = radius of carbon atom

iii) $F_e = (9 \times 10^9) \times (1.66) \times \dfrac{(1.6 \times 10^{-19})^2}{(2.7 \times 10^{-15})^2} = 52$ N

iv) $F_g = 6.7 \times 10^{-11} \times 1.66 \times \dfrac{(1.7 \times 10^{-27})^2}{(2.7 \times 10^{-15})^2} = 4.4 \times 10^{-35}$ N

v) $\dfrac{F_e}{F_g} = \dfrac{52}{4.4 \times 10^{-35}} \approx 1.2 \times 10^{36}$

vi) Along the diameter, radially outwards.

Question 35

A)

i) $2KClO_3 \rightarrow 2KCl + 3O_2$

   $2(39 + 35.5 + 48) = 245g$ $3 \times 32 = 96g$

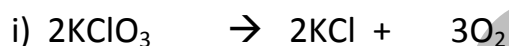Amt. of pure $KClO_3$ in 90g of 60% purity (90 x 0.6) =54g

According to eq(i) 245g of $KClO_3$ = 96g of O_2

$\therefore$ 54g of $KClO_3$ = (96X54)/245 =21.2g of O_2

ii) $2H_2 + O_2 \rightarrow 2H_2O$
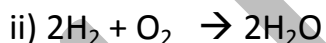
   4g   32g

According to eq (ii) 32 g of O_2 = 4g of H_2

21.2 g of O_2 = (21.2X 4)/32 = 2.65 $\cong$ 2.7g of H_2
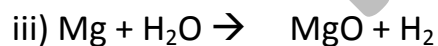
iii) $Mg + H_2O \rightarrow MgO + H_2$
24g   2g

According to eq (iii) 2 g of H_2 = 24g of Mg

2.7 g of H_2 = (24X2.7)/2 = 32.4 g of Mg

OR 2.65 g of H_2 = (24 x 2.65)/2 = 31.8 g of Mg

B)

This is a thermite reaction.

I) A= Al   B= (Fe_2O_3)   C= Fe   D = Al_2O_3

II) $Fe_2O_{3(s)}$ + 2Al $_{(s)}$ $\rightarrow$ $2Fe_{(l)}$ + $Al_2O_{3(s)}$ + Heat
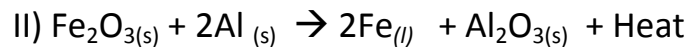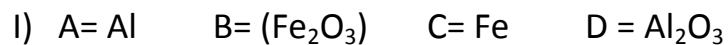
Displacement reaction

III)   Amphoteric

IV) Al_2O_3 + 2NaOH $\rightarrow$ $2NaAlO_{2(aq)}$ + $H_2O_{(l)}$
Al_2O_3 + 6HCl $\rightarrow$ $2AlCl_{3(aq)}$ + 3 $H_2O_{(l)}$
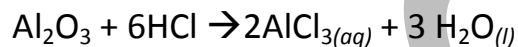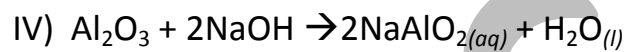
Question 36

I) i) Autosomal recessive: **a. and b.**

ii)   X-linked recessive: **a. and b.**

II) Option **d** is correct. **2/3**

III)

i.   Son   answer: **0**
ii.   Daughter   answer : **1**

Question 37

i) Since the tank is moving with uniform velocity, the free surface of water will remain horizontal (No need to sketch the free surface)

ii) After t = 5 s, since the tank is accelerated uniformly, the free surface will not remain horizontal. In fact a pseudo force (or pseudo acceleration) will act in the tank frame in the opposite direction. This makes the free surface inclined to the horizontal with water rising along the backside. The situation will be as shown.
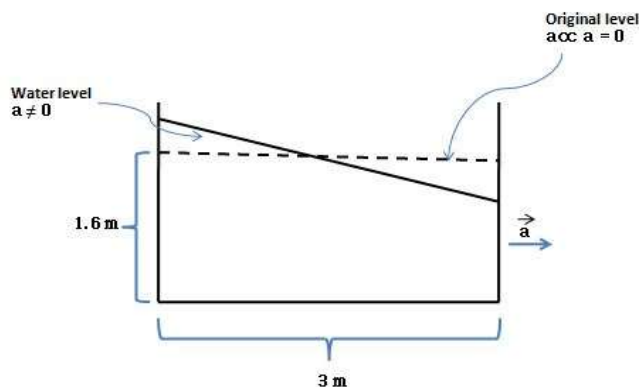
iii) To find the maximum acceleration a_{max} for the water not to spill over, the situation is as shown below.
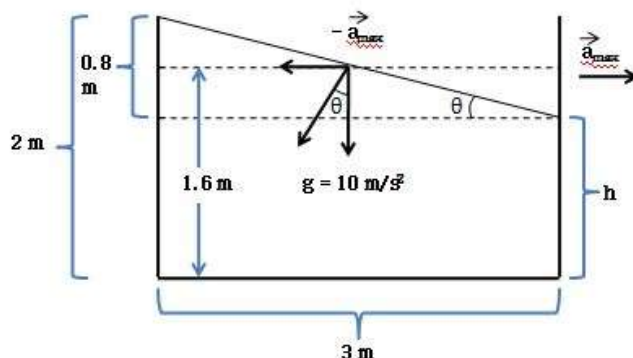
To find h, we equate the volumes in the two situations with changed geometry.

The surface tilts uniformly and it is plane even in the tilted position (as shown in the figure).

The free surface of water will remain perpendicular to the net acceleration which is the vector sum of g (downwards) and $-a_{max}$ (pseudo acceleration) as shown.

From simple geometry,

$\tan \theta = \frac{0.8}{3} = \frac{a_{max}}{10}$

$\therefore a_{max} = \frac{10 \times 0.8}{3} = \frac{8}{3} = 2.66 \, m/s^2$

iv) The correct option is (d). The air bubble always travels perpendicular to the free surface.

Question 38

A)

Molecular mass of ammonium chloride (NH_4Cl) = 14+4+35.5= 53.7
10.7 % of ammonium chloride = 2 molar ammonium chloride solution
$Ca(OH)_2$ (s) + $2NH_4Cl$(aq) → $CaCl_2$ (aq) + $2NH_3$ (g) + $2H_2O$ (l)
74g   34 g
Ammonia gas produced in the above reactions now reacts with 23.85 g CuO

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$2NH_3$ (g) + $3CuO$ (s) → $3Cu$ (s) + N_2 (g) + $3H_2O$ (l)
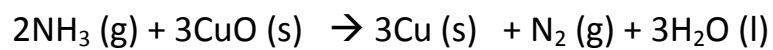
2 mole   3 moles   3 moles

  2 x 17   3×79.5   3×63.5

  34   238.5g   190.5g

  3.4   23.85g   19.05g

Amount of slaked lime required is 7.4 g

Amount of Copper obtained is 19.05 g

$Ca(OH)_2$ ≡ 2 NH_3 ≡ 3 Cu

74   34   190.5

B)
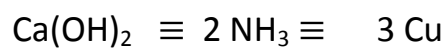
i) oq_3 *OR* $AsCl_3$

ii)   g *OR* Mn (+2 to +7)

iii)   g *OR* $KMnO_4$

iv)   Coinage elements: h, j, k   *OR*   Fe, Ni, Cu

v)   o *OR*   As

vi)   l *OR*   Zn

Question 39

1. The correct option is (b) i.e Keep the plant in dark for about 48 hours before starting the experiment.

2. The correct option is (c) i.e Iodine solution

3. The correct option is (c) i.e Excitation of chlorophyll

4. The correct option is (a) i.e Accumulation of more water

5. The correct option is (c) i.e Sucrose

6. The correct option is (b) i.e As long as the test tube is illuminated by white light and sodium bicarbonate is present in it.
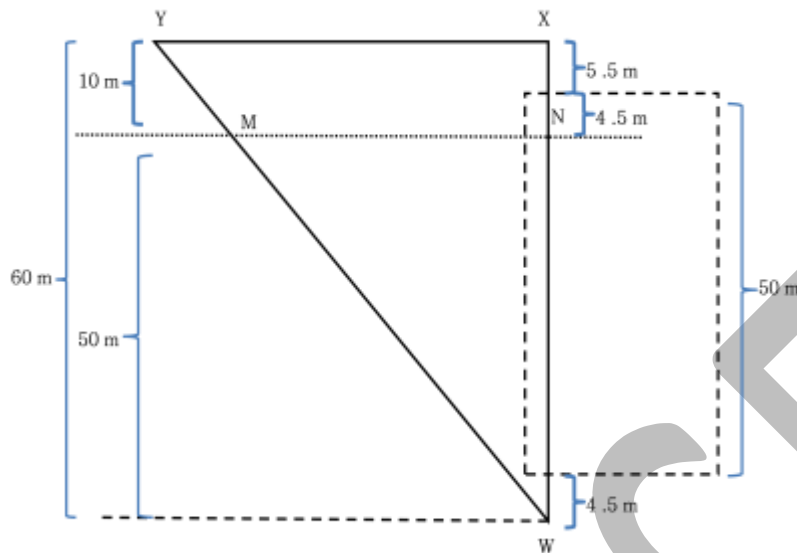
Question 40

A)

qV = Change in kinetic energy = $\frac{1}{2}m(v^2 - u^2)$

$q.10 = (1/2)(0.02)(40^2 - 20^2) = 12$

$q = 1.2$ C

B)

i) Mass of ice = V/910 kg = A x 50 x 910 kg

So mass of water displaced = A x h x 1000 kg.

50x 910 = h x 1000

h = 50 x .91 = 45.5 m

So 4.5 m of ice projects out of water (is above the surface of water). Hence there is 5.5 m of air between X and ice surface.

Also whale is 4.5 m below the sheet of ice.

ii) YW = $(6400 + 3600)^{1/2}$ = 100 m

Taking ratio of 10/60 in 100m gives YM = 16.6 m and MW = 83.4 m.

iii) Time taken *for the sound* to reach Y is (16.6/350 + 83.4/1500) = 0.103s   iv) Time taken to travel to x = 0.033 s

v) Travel time in air is 5.5/350 = 0.016 s and in water below the sheet of ice it is 4.5/1500 = 0.003 s with total time 0.019 sec. Travel time of sound in ice is thus 0.033 – 0.019 = 0.014 s for 50 m hence its speed in ice is 3571 m/s.

Question 41

A)

Vol of 2 drops of 1 M NaOH = (6 x 2)/ 100 =   0.12 mL

Conc of HCl = (conc NaOH x vol NaOH) / vol HCl = (0.12 / 5) = 0.024 M

Grams of HCl =(0.024 x 5 x 36.5)/ 1000   = 0.00438 g

B)

 (i) Molarity of sodium hydroxide,
M= 0.05 X 10 X 2 / 11.3 = 0.0885M

Amount of NaOH in the solution
gm/ 250 mL. of NaOH,
= 40 X 0.0885 X 250 / 1000 = 0.885 g

Amount of NaOH spilled = 1 - 0.885 = 0.115 g

(ii) 1000mL 1Molar any solution contain 6.02×10^{23} molecules

Number of NaOH molecules in 0.0885 M 11.3 mL

$\qquad$ = $(0.0885 \times 11.3 \times 6.02 \times 10^{23}) \div 10^3$

$\qquad$ = 6.02×10^{20} molecules of NaOH

 Number of dibasic acid molecules in 0.05 M 10 mL

= $(0.05 \times 10 \times 6.02 \times 10^{23}) \div 10^3$

= 3.01×10^{20} molecules of dibasic acid

Question 42

A) I) 5.

II) A= 400J, B= 400J, C=400J, D=20J, E=84J, F=20J

III) Grass -> Rabbit -> Eagle

B) I) The correct option is (a) i.e 12 J

   II) The correct option is (c) i.e 75 %

C) The correct option is (a) i.e (a) Birds → Mammals → Fishes → Microorganisms.