

P525/1 CHEMISTRY

MARKING GUIDE

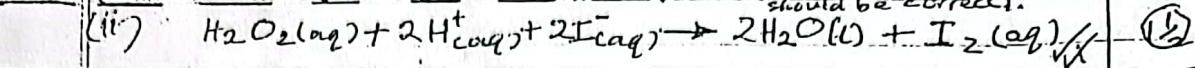
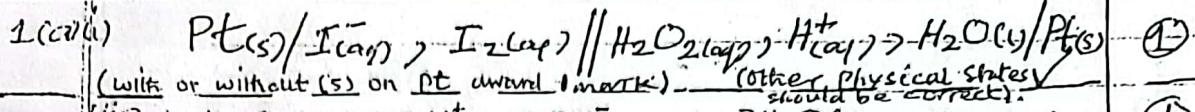
AUGUST, 2024

-1-

Ques.
No.

Correct answer / Marks to be awarded for

NO. OF
Marks ↴



(bvi)

$$\text{E.M.F. of cell} = E_{\text{right}} - E_{\text{left}}$$

$$= 1.77 - 0.52$$

(1)

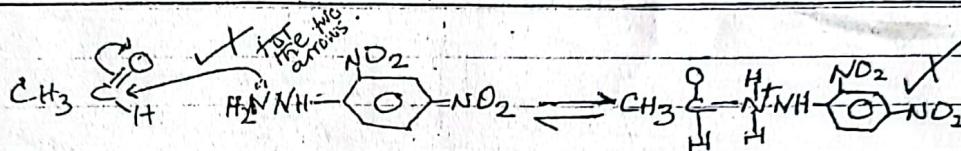
$$(\text{Deny 1 mark if the sign is missing}) = +1.25 \text{ V}$$

13, (i)

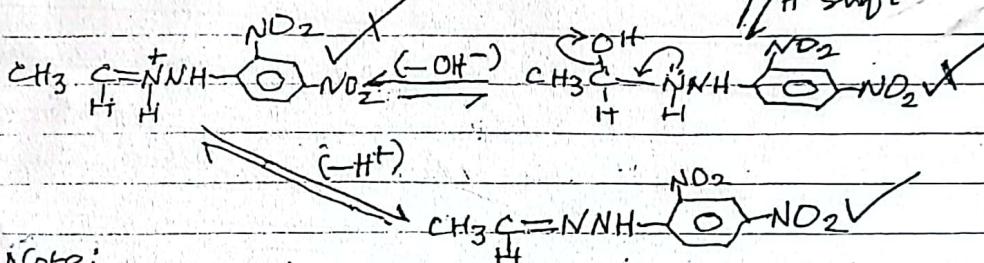
Feasible ✓ because emf of the cell is positive ✗

Total 4½

2(a)



✓ H+ shift



(2)

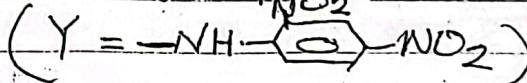
Note:

⇒ If H+ shift is indicated score ½ for the intermediate and if (-OH-) is indicated score ½ mark for intermediate and if (-H+) is indicated score 1 mark for the final product.

⇒ Allow without reversible signs.

Allow using Y—NH₂

⇒ Ignore equilibrium sign if not used



Allow protonation of the carbonyl in the first step

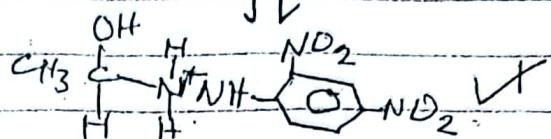
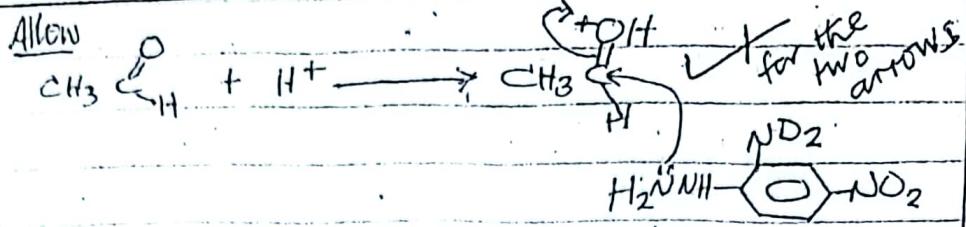
Quest No

Correct consider / marks to be awarded for

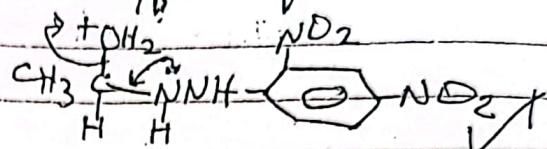
marks

Allow

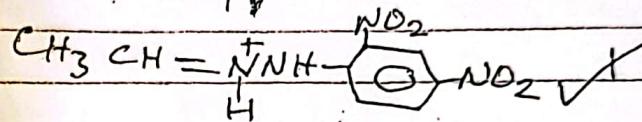
2(a)
(Contd.)



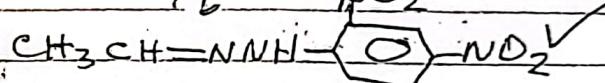
|| H⁺ shift



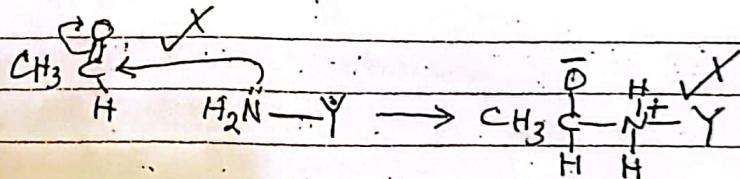
|| -H₂O



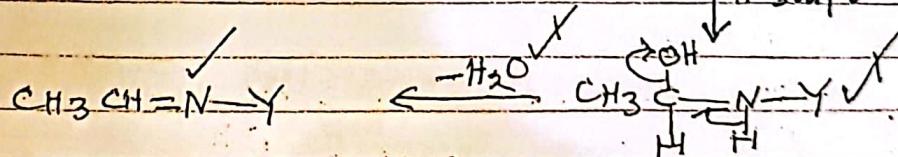
|| -H⁺



Allow



H⁺ shift



Note:

Score $\frac{1}{2}$ mark for the intermediate if

H⁺ shift, -H₂O are shown and 1 mark for

the final product is -H⁺ is indicated

The mark for the product can be

scored on completing the equation or

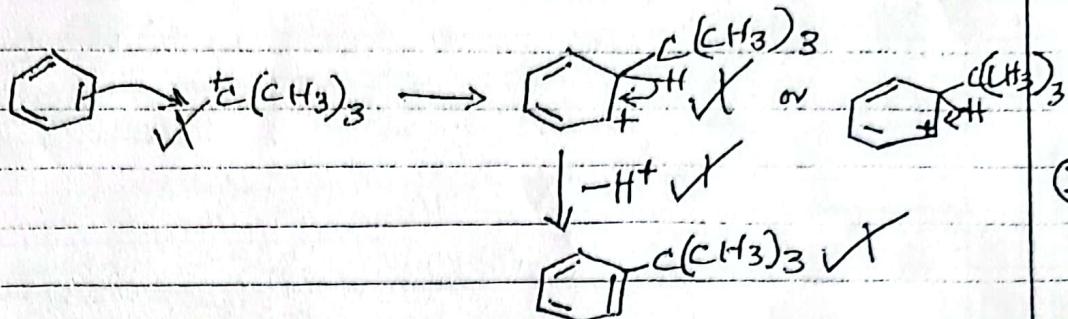
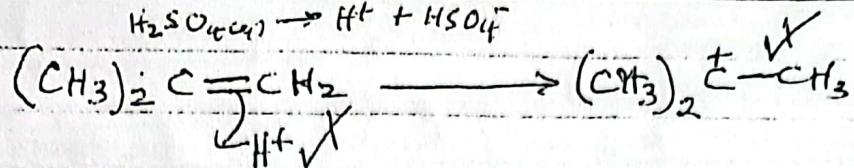
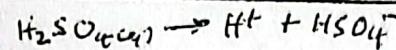
at the end of the mechanism.

No.

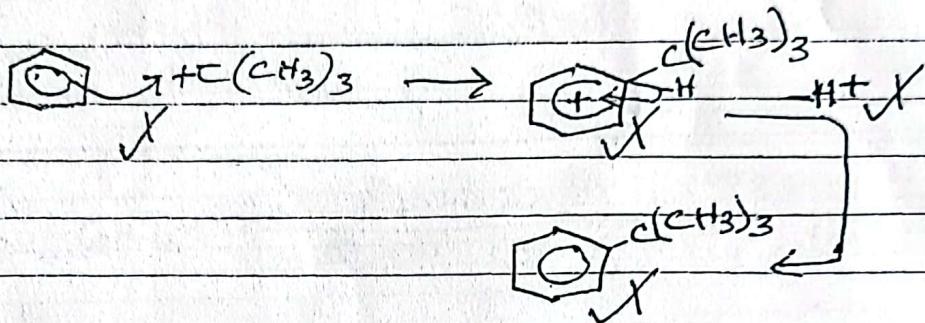
Correct answer / marks to be awarded for

No. of
marks

2(b)



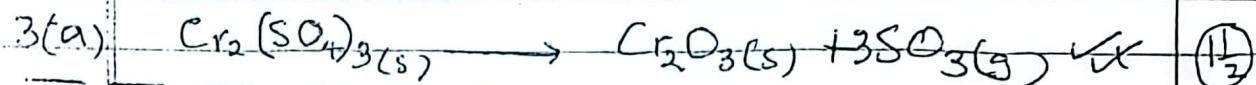
OR



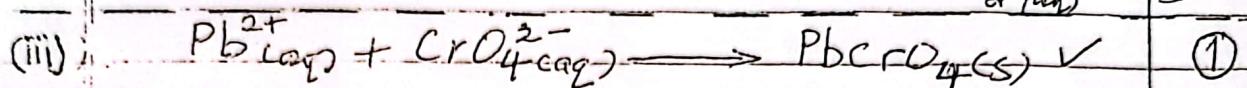
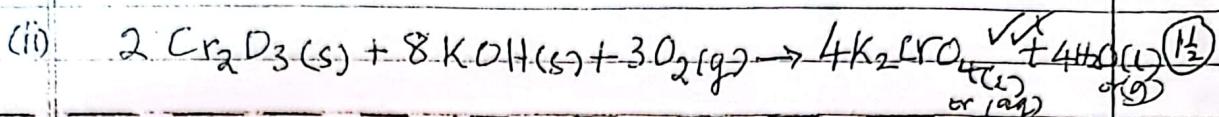
(Note:)

In all cases where the benzene ring is required - allow a circle or bonds if correctly used inside the ring.

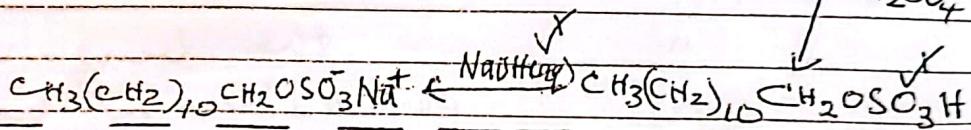
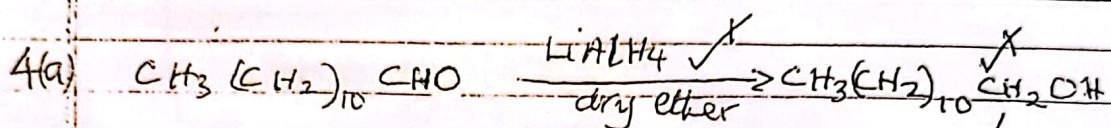
Quest No. Correct answer / marks to be awarded for Marks



b(i) The green solid: dissolves forming
a yellow liquid or solution ✓ ①



05



b(i) Soapy detergents \Rightarrow are biodegradable
so they do not pollute the environment
allow that it is cheaper ①

(ii) Soapy detergents - form scum
with hard water ①

4½

Note:

Inorganic equations should be balanced, have
correct physical states and symbols to
earn full credit

Wrong symbols score zero

Wrong or missing physical states (-½ mark)

No Correct answer/marks to be awarded for

No of marks

5(a) % of hydrogen = $100 - (26.7 + 71.10) = 2.2 \checkmark$



moles of atoms: $\frac{26.7}{12} ; \frac{2.2}{1} ; \frac{71.1}{16}$

$$2.225 ; 2.2 ; 4.444 \checkmark$$

$$\frac{2.225}{2.2} ; \frac{2.2}{2.2} ; \frac{4.444}{2.2}$$

$$\approx 1 ; 1 \quad 2.0 \checkmark$$

i. Empirical formula of R = $\text{CH}_2\text{O}_2 \checkmark$

②

(b)

$$M_A = \frac{mRT}{PV} = \frac{0.2 \times 8.31 \times 588}{101325 \times 110 \times 10^{-6}}$$

$$= 87.68 \text{ g } \checkmark$$

$$(\text{CH}_2\text{O}_2)_n = 87.68$$

$$12n + n + 32n = 87.68$$

$$45n = 87.68$$

$$n = 1.95 \approx 2 \checkmark$$

i. Molecular formula is $\text{C}_2\text{H}_2\text{O}_4 \checkmark$

②

OR $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \checkmark$

$$\frac{101325 \times 110}{588} = \frac{101325 \times V_2}{273}$$

$$V_2 = 51.07 \text{ cm}^3$$

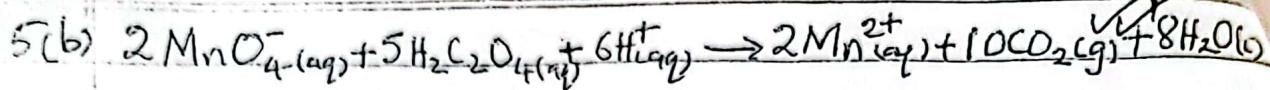
51.07 cm^3 of R weigh 0.2g

22400 cm^3 of R weighs $\frac{0.2}{51.07} \times 22400 \text{ g}$

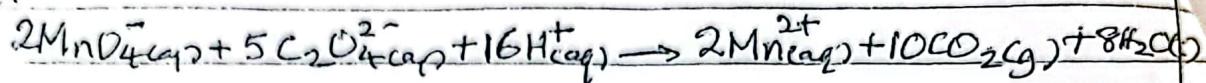
$$M_A = 87.72 \checkmark$$

Ques:

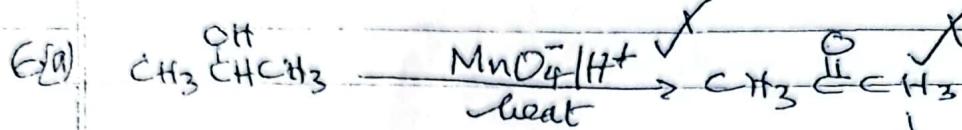
correct answer / marks to be awarded for



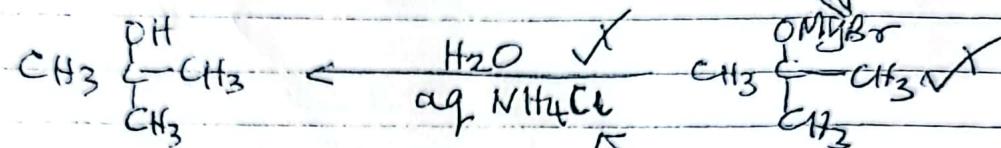
or



5L
52

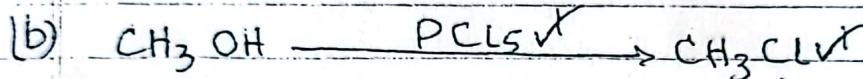


CH_3MgBr ✓
dry ether



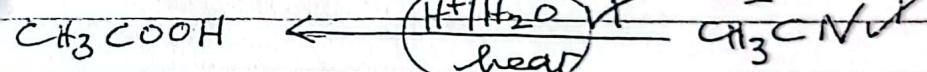
(allow correct alternatives) respect $[\text{H}^+/\text{H}_2\text{O}]^5$

2L
22



~~(99% alcohol | KCN)~~

~~heat~~



(allow correct alternatives)

- Dry ether should be indicated with gridmark reagent

END Correct answer/marks to be awarded for

No of marks

7(a) Iron forms complexes ✓

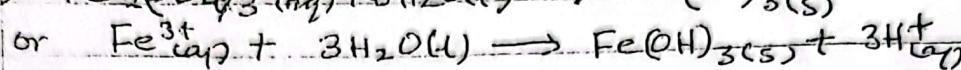
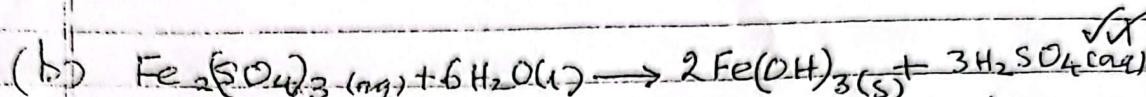
Iron forms coloured compounds ✓

(1)

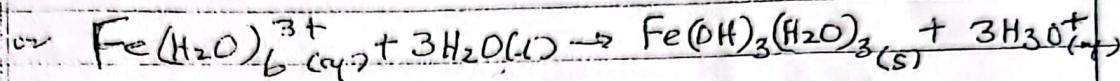
Iron acts as a catalyst

Iron has variable oxidation states

(Accept any two correct). extra wrong one - $\frac{1}{2}$

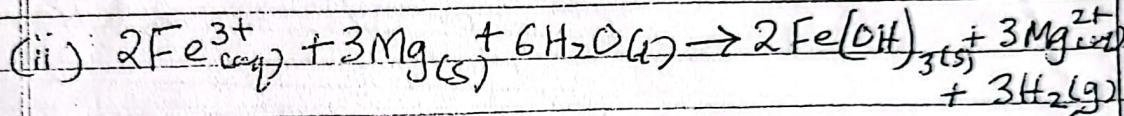


($\frac{1}{2}$)

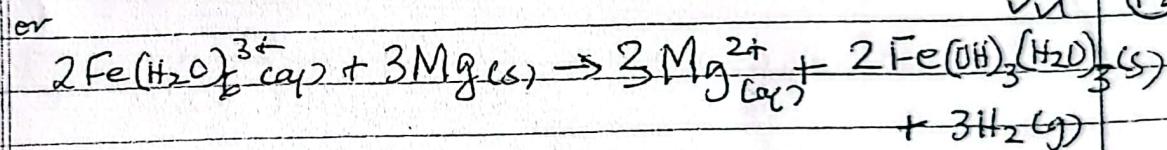


(c)(i) Reddish-brown, Brown precipitate and bubbles or effervescence of colourless gas ✓

(1)



($\frac{1}{2}$) ✓



05

Quest
No

Correct answer/ marks to be awarded for

-8-

8(a) Raoult's law of a binary mixture state that;

'the partial vapour pressure of a volatile component in a solution is equal to the vapour pressure of that pure component multiplied by its mole fraction in the solution at that temperature.'

(1)

(ii) The law is valid when:

- No heat change during formation of the solution (1)
- No volume change during formation of the solution
- When intermolecular forces between unlike molecules are similar to those between like like molecules

(accept any correct two) ans extra wrong one -x₂

(b) (i) V.P of A = $x_A P_A^{\circ} \checkmark$ = $0.5 \times 12.00 = 6 \text{ KNM}^{-2}$

V.P of B = $x_B P_B^{\circ} \checkmark$ = $0.5 \times 4.92 = 2.46 \text{ KNM}^{-2}$ (2)

V.P of the mixture = $6 + 2.46$
= $8.46 \text{ KNM}^{-2} \checkmark$

(ii) Composition of A in the vapour.

$$= \frac{\text{V.P of A}}{\text{V.P of the mixture}}$$

$$= \frac{6}{8.46} \checkmark$$

$$= 0.71 \checkmark$$

Quest. No

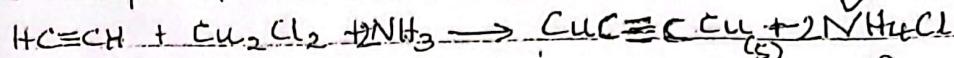
Correct answer/marks to be awarded for

-9-

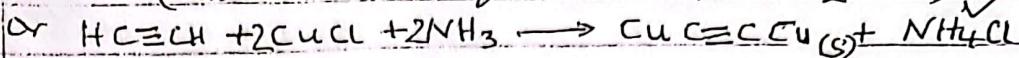
Two
marks

9(a)

Red precipitate/solid ✓



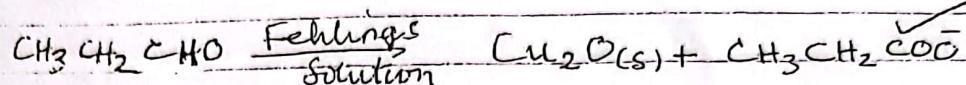
(Unbalanced equation award 1/2 mark) ✓



(Should be balanced to earn 1 mark) ✓

(b)

Red precipitate or reddish-brown ppt. ✓



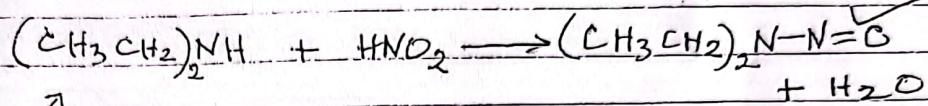
1½

(Allow unbalanced equation with or without physical states) ✓

c

Yellow oil or yellow oily liquid. ✓

1½



(Equation should be balanced with or without physical states to earn 1 mark. Give 1/2 mark if equation is not balanced.)

(Ignore physical states in all cases) ✓

4½

Quest:
No.

Correct answer/marks to be awarded for

M
C
m

10(a) Acidified Potassium manganate(VII) Solution and heat or Hot acidified Potassium manganate(VII) Solution ✓

$\text{CH}_3\text{COO}^{\ominus}$ (aq) \rightarrow No observable change ✓ (3)
 COO^{\ominus}
 $\text{COO}^{\ominus} \text{ (aq)}$ \rightarrow Purple Solution turn colourless and bubbles of a colourless gas.

OR Iron(III) Chloride Solution ✓

* Reject the reagent name without the word solution.

$\text{CH}_3\text{COO}^{\ominus}$ (aq) \Rightarrow Red-brown colouration/solution or reddish brown colouration/solution

COO^{\ominus}
 COO^{\ominus} \Rightarrow light green colouration/solution

(b) Dilute hydrochloric acid ✓

or Dilute Sulphuric acid

Dilute nitric acid

SO_3^{2-} \Rightarrow Bubbles/effervescence of a colourless gas. (3)

$\text{S}_2\text{O}_3^{2-}$ \Rightarrow Yellow solid and bubbles/effervescence of a colourless gas.

c) Hot sodium hydroxide Solution followed by dilute nitric acid followed by Silver nitrate Solution ✓

$\text{CH}_2\text{Br} \Rightarrow$ Pale yellow precipitate ✓ (Reject cream precipitate) (3)

$\text{H}_3\text{C}-\text{Br} \Rightarrow$ NO observable change ✓

* Reject reagent if the word solution is missing

* If the reagent is wrong the observations do not score.

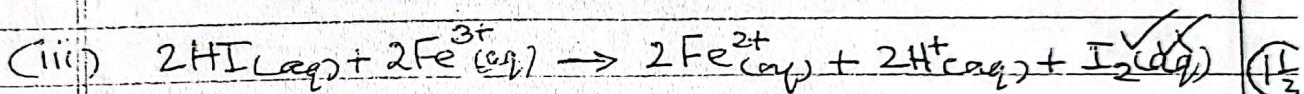
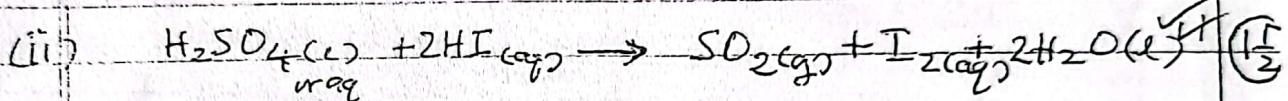
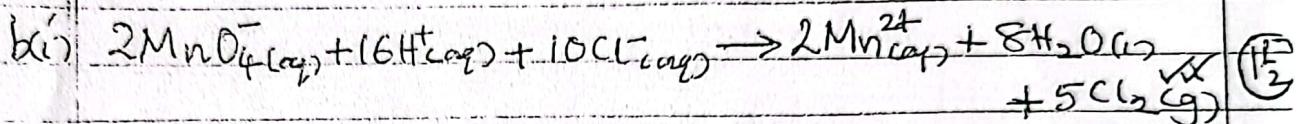
9

Ques No:

Correct answer/marks to be awarded for

- (1) Fluorine has a smaller atomic radius than Iodine atom ✓

Therefore the covalent bond in hydrogen fluoride is stronger than in hydrogen iodide. Hence the hydrogen-fluorine bond is more difficult to break than the hydrogen-iodine bond ✓ thus fewer hydrogen fluoride molecules ionise in aqueous solution to form hydrogen ions than hydrogen iodide



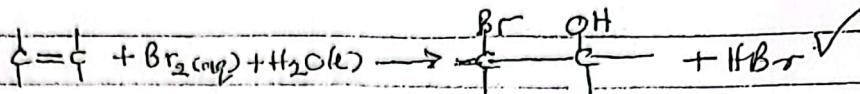
- (c) In b(i) a greenish-yellow gas are evolved ✓ (1)

In b(ii) the yellow ✓ solution turn brown (1)

- (d) In b(iii) hydrochloric acid reduces X Iron(III) to Iron(II) and is itself oxidised ✓ to Iodine (1)

Quest. No	Correct answer / marks to be awarded for	No. marks
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- 12(a) Functional group \Rightarrow carbon to carbon double bond
 Observation: Reddish brown or brown solution turn colourless. ✓ (3)

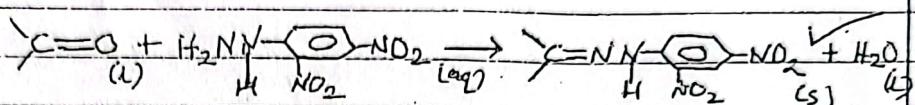


Ignore physical states

Balanced equation 1 mark

Unbalanced equation $\frac{1}{2}$ mark
 (without HBr)

- (b) Functional group \Rightarrow carbonyl group ✓
 Observation: Orange or yellow precipitate ✓



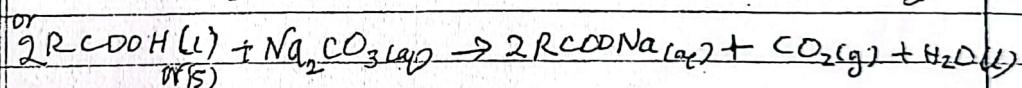
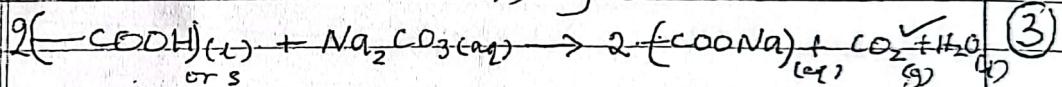
Ignore physical states

Balanced equation 1 mark

Unbalanced equation $\frac{1}{2}$ mark
 (without H_2O)

- (c) Functional group \Rightarrow Carboxyl group ✓

Observation: Bubbles/Effervescence of a colourless gas. ✓



Note: { Ignore physical states

Balanced equation 1 mark.

Unbalanced equation $\frac{1}{2}$ mark
 (without H_2O)

91

Ques.
No.

Correct answer/marks to be awarded for

NO OF
marks

13(a) Molar Conductivity - is the conductivity of a solution containing one mole of an electrolyte ✓ (1)

OR Conductivity of a solution divided by Concentration of the solution

OR Is the conductance of 1 mole of an electrolyte in a given volume of solution.

Electrolytic conductivity - is the reciprocal of resistivity ✓ (1)

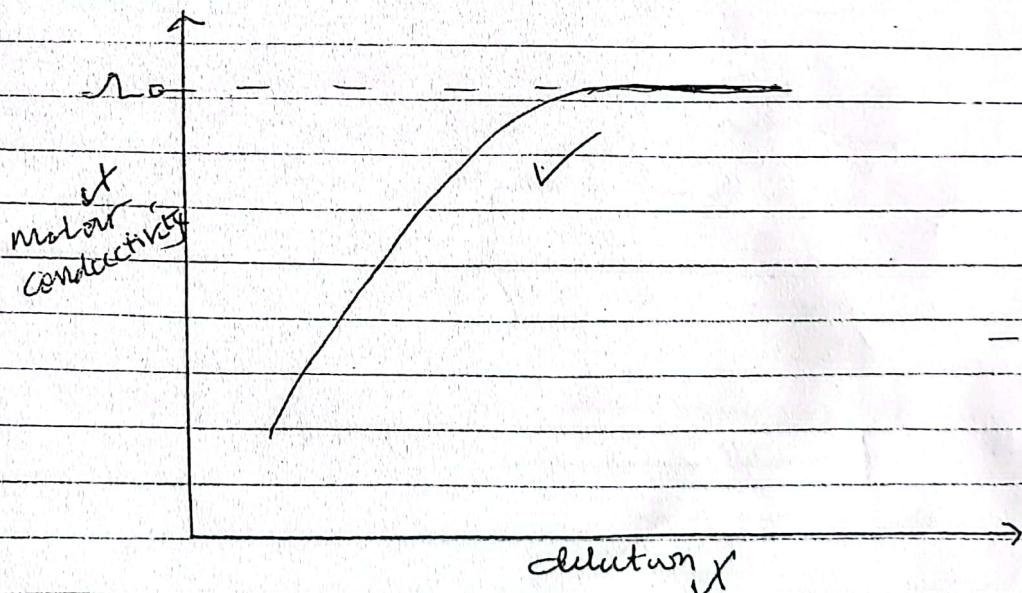
or

Conductivity of a Solution of an electrolyte placed between electrodes 1m (metre) apart and cross-sectional area $1\text{metre}^2 (1\text{m}^2)$ each,

allow 1cm apart and 1cm^2 cross-sectional area,

→ a unit length apart and unit cross-section area..

b(i) A graph of molar conductivity of sodium chloride with dilution



Test No. Correct answer/marks to be awarded for No. of marks

13. b(ii) Explaining the shape of the graph.

Molar conductivity increases with increasing dilution until at infinite dilution when it becomes constant.

This is because as dilution increases the ions get further apart. This reduces the drag on the mobility of the ions thus molar conductivity increases.

(14)

OR This reduces ionic interferences and hence mobility of the ions increases

$$(C20) \quad I_c = \frac{K \times 10^{-3}}{c} = \frac{1.96 \times 10^{-2} \times 10^{-3}}{0.016} = 1.225 \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$$

(1)

$$(ii) \quad \alpha = \frac{I_c}{I_0} = \frac{1.225 \times 10^{-3}}{3.5 \times 10^{-2}} = 0.035$$

(25)

$$K_a = \frac{\alpha^2 c}{1-\alpha} = \frac{(0.035)^2 \times 0.016}{1-0.035} = 2.03 \times 10^{-5} \text{ mol dm}^{-3}$$

$$\text{or } K_a = \alpha^2 c = (0.035)^2 \times 0.016 \\ = 1.96 \times 10^{-5} \text{ mol dm}^{-3}$$

(ignore units)

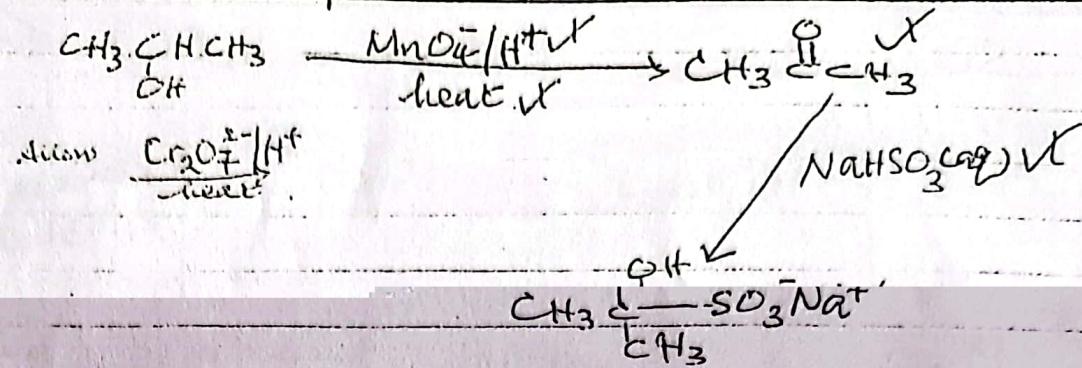
09

Ques.
No.

Correct answer/ Marks to be awarded for

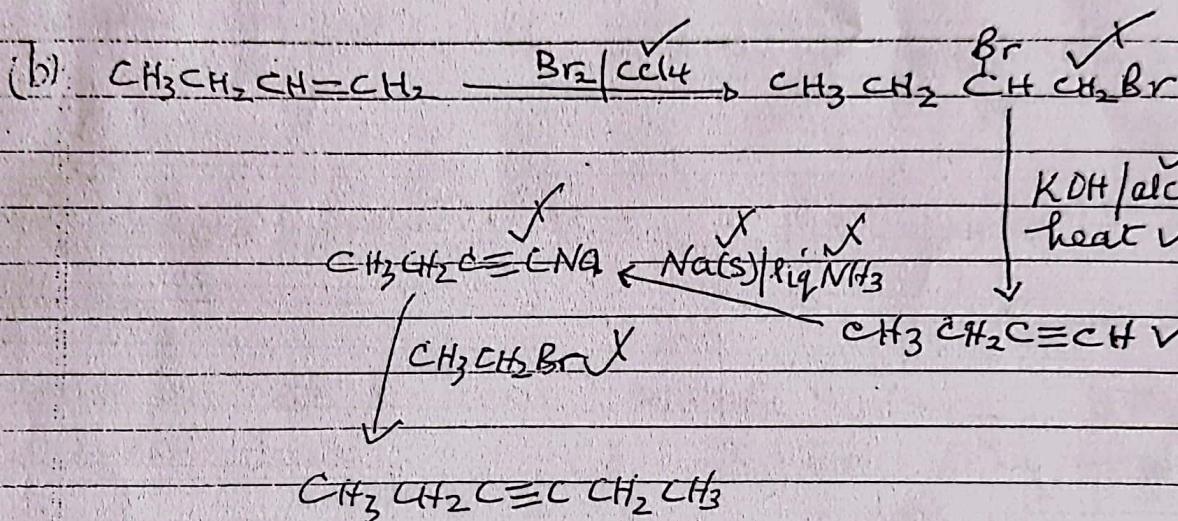
No of
marks

(i) (a)



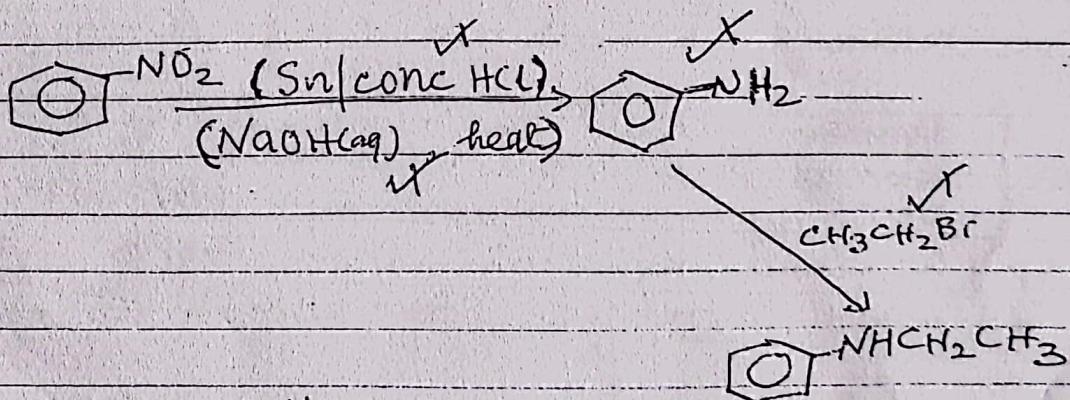
(2)

(b)



(5)

(c)



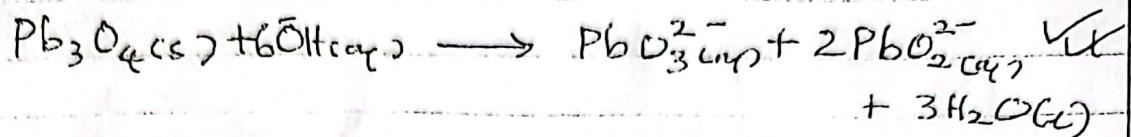
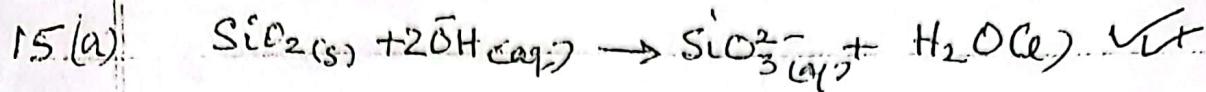
(2)

Reject: (LiAlH_4 in place of $\text{Sn} / \text{conc HCl}$)

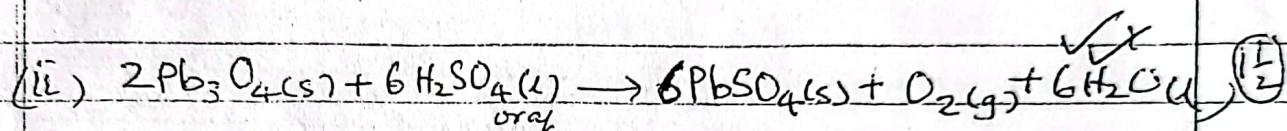
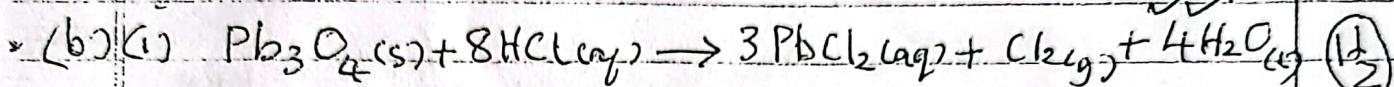
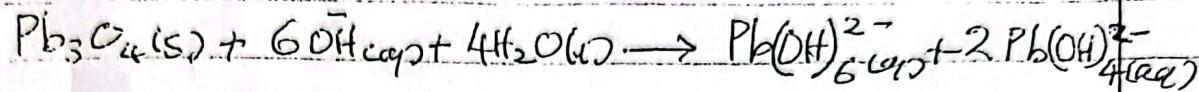
9

Correct answer/marks to be awarded for

No.
marks

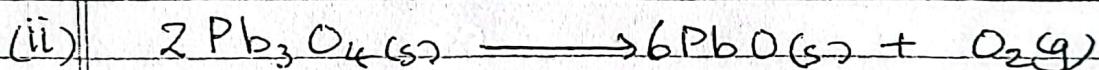


or



i) The red solid turned to a brown or reddish brown solid when hot and yellow when cold.

1½



1½

- { Equations should be balanced, should have correct physical states to earn 1½ marks)
- with wrong or missing physical states (-½ mark) 09
- Unbalanced equation Score zero
- wrong symbols Score zero for the equation

(To be fastened together with other answers to paper)

UACE

Candidate's Name

Random No.

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Signature

Personal Number

Subject Name Paper code /

16(a)(i) A Graph of pH against volume of hydrochloric acid.

Quest.
No.

Correct answer/marks to be awarded for

16(a)(i)

See graph paper. ... Page 17

Plot/spread ✓

Shape ✓

Axes ✓

(ii)

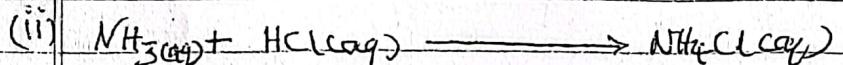
Initially at A, the pH is higher than seven because the concentration of ammonia is high. pH gradually decreases along AB because ammonia is being neutralised by the acid. The decrease is gradual because the remaining ammonia forms a buffer solution with ammonium chloride formed.

At B, end point occurs and a small amount of acid added causes a sharp decrease in pH along BC.

pH at the end point is below seven because ammonium chloride formed undergoes hydrolysis to form an acidic solution.

Along CD there is a gradual decrease in pH due to hydrogen ions from excess acid added.

b(i) pH at the end point = 5.3 (± 0.1) ✓



From the graph volume of HCl required to neutralise $\text{NH}_3(\text{aq})$ = 16.5 cm^3 (± 0.1)

$$\text{moles of } \text{NH}_3(\text{aq}) = 0.1 \times 25 = 2.5 \times 10^{-3}$$

$$\text{moles of } \text{NH}_4\text{Cl} = \text{moles of } \text{NH}_3(\text{aq}) = 2.5 \times 10^{-3} \text{ mol}$$

Total volume of solution at the end point

$$= 25 + 16.5 = 41.5 \text{ cm}^3$$

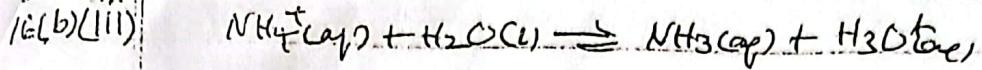
41.5 cm^3 of the solution contain 2.5×10^{-3} moles of NH_4Cl

1000 cm^3 of the solution contain $\frac{2.5 \times 10^{-3}}{41.5} \times 1000$ moles of NH_4Cl

$$\therefore \text{Molarity of } \text{NH}_4\text{Cl} = 0.06 \text{ M}$$

Sect
NC

Correct answer/marks to be awarded for



$$K_h = \frac{[\text{NH}_3][\text{H}_3\text{O}^+]}{[\text{NH}_4^+]}$$

At equilibrium $[\text{NH}_3] = [\text{H}_3\text{O}^+]$ and $[\text{NH}_4^+] = 0.06\text{M}$

$$K_h = \frac{[\text{H}_3\text{O}^+]^2}{0.06} \quad \checkmark$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = 5.3$$

$$[\text{H}_3\text{O}^+] = 10^{-5.3} = 5.01 \times 10^{-6}\text{M} \quad \checkmark$$

$$K_h = \frac{(5.01 \times 10^{-6})^2}{0.06}$$

$$= 4.018 \times 10^{-10} \quad \checkmark$$

(1½)

09