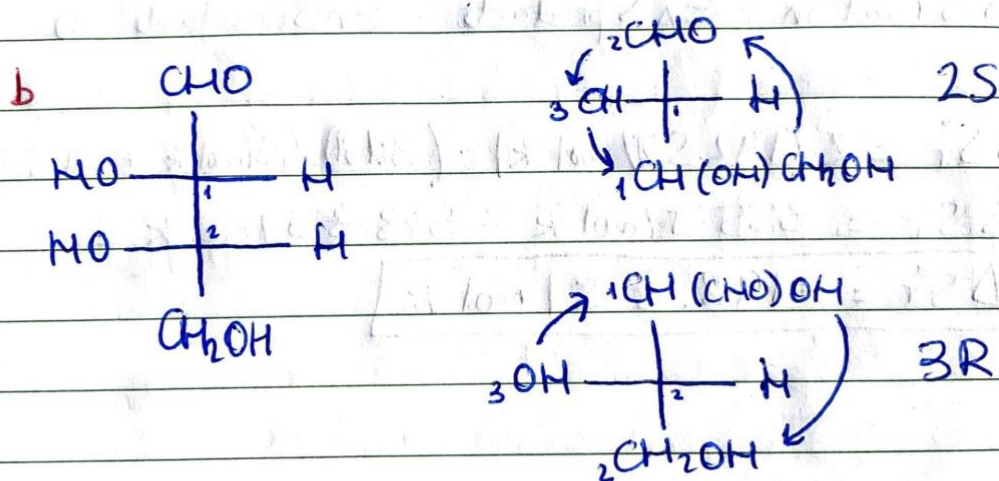


The direction of travel from highest to lowest (1-3) is clockwise, so the Fischer project of 2-bromobutane above represents the R-enantiomer: R-2-bromobutane.



Using the Cahn-Ingold-Prelog rules, the systematic name will be: (2S,3R)-2,3,4-trihydroxybutan-1-al.

c. $c = 2\% = 0.02 \text{ g/mL}$ $[\alpha]_D^{25} = \frac{[\alpha]_{\text{obs}}}{l \cdot c}$

$l = 20 \text{ cm} = 2 \text{ dm}$

$[\alpha]_{\text{obs}} = -1.8^\circ$


$[\alpha]_D^{25} = \frac{-1.8^\circ}{2 \text{ dm} \cdot 0.02 \text{ g/mL}} =$

$[\alpha]_D^{25} = -45^\circ$

② a. Aspartic acid, ASP

II. ASP has a negative charge when pH is neutral. The side chain tends to form salt bridges with other charged amino acid side chains. The carboxyl groups usually release a H^+ and exist as COO^- . This makes them acidic and highly hydrophilic.

III.

+  - At pH=7, ASP (pI=3.0)

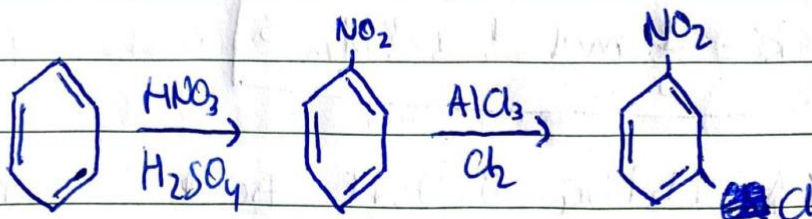
will be in the anionic form.

IV. Because ASP will be in anionic form with pH=7, at electrophoresis the molecule will migrate to the anode(+).

b. 2,5-dimethylbenzoic acid

c. I. HNO_3 and H_2SO_4

II.



③ a. $v = k [A]^x [B]^y$

$$\frac{4.0 \times 10^{-4}}{6.0 \times 10^{-4}} = \frac{\cancel{k} (0.03)^x \cancel{(0.04)^y}}{\cancel{k} (0.045)^x \cancel{(0.04)^y}}$$

$$\frac{2}{3} = \left(\frac{0.03}{0.045} \right)^x \rightarrow \frac{2}{3} = \left(\frac{2}{3} \right)^x \rightarrow x = 1$$

$$\frac{6.0 \times 10^{-4}}{9.0 \times 10^{-4}} = \frac{\cancel{k} \cancel{(0.045)^x} (0.040)^y}{\cancel{k} \cancel{(0.045)^x} (0.060)^y}$$

$$\frac{2}{3} = \left(\frac{0.040}{0.060} \right)^y \rightarrow \frac{2}{3} = \left(\frac{2}{3} \right)^y \rightarrow y = 1$$

$$v = k [A][NaOH]$$

$$k = \frac{v}{[A][NaOH]}$$

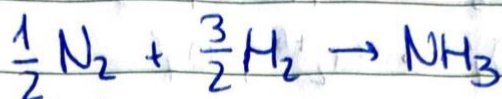
$$k = \frac{4 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}}{(0.03)(0.04) \text{ mol}^2 \text{ dm}^{-3}} = \frac{1}{3} \text{ mol}^{-1} \text{ s}^{-1} \text{ dm}^3$$

$$k = \frac{1}{3} \text{ mol}^{-1} \text{ s}^{-1} \text{ dm}^3$$

b. 1 NaH₂PO₄ 0.05M Acid • pK_a = -log k_a
 Na₂HPO₄ 0.045M Base pK_a = 7.21

$$pH = pK_a + \log \left(\frac{[\text{base}]}{[\text{acid}]} \right) = 7.21 + \log \left(\frac{0.045}{0.05} \right) =$$

$$pH = 7.16$$

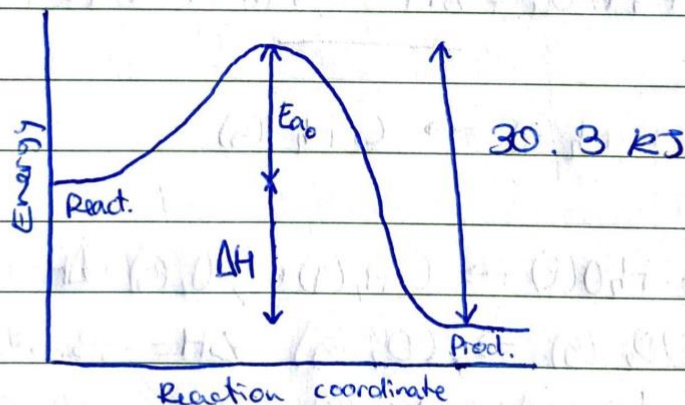


M_0 0.25 0.4 —

M_{eq} $0.25 - \frac{x}{2}$ $0.4 - \frac{3x}{2}$ x

M_{eq} 0.2125 0.2875 0.075

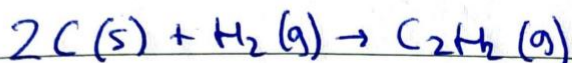
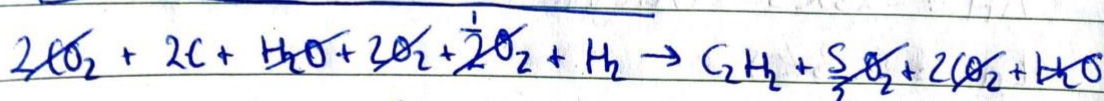
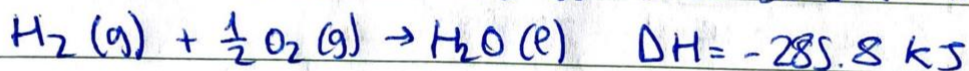
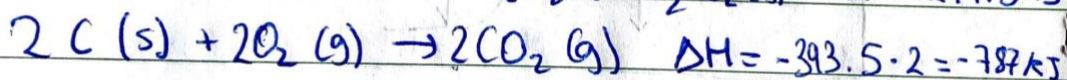
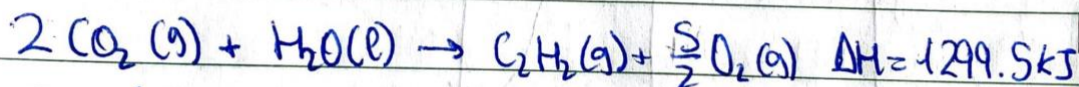
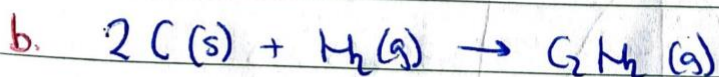
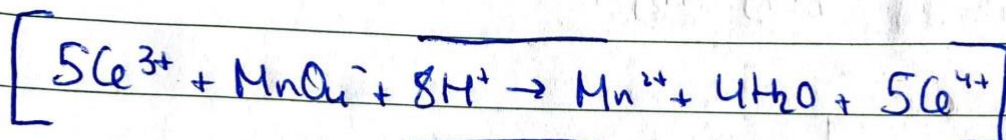
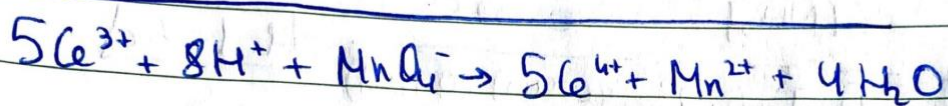
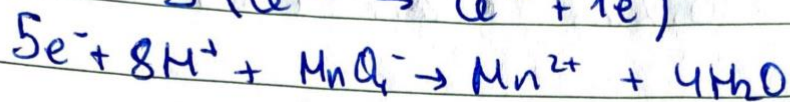
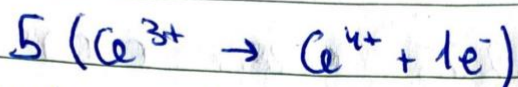
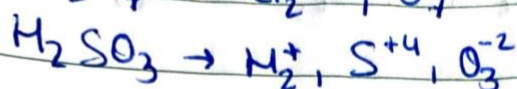
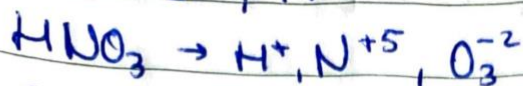
$$K_c = \frac{[NH_3]}{[N_2]^{\frac{1}{2}} [H_2]^{\frac{3}{2}}} = \frac{0.075}{(0.461)(0.154)} = \boxed{1.1 = K_c}$$



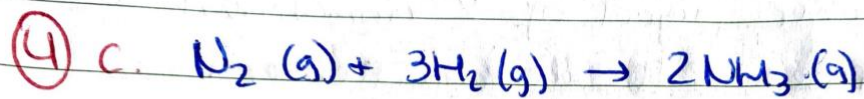
$\Delta H = -25 \text{ kJ}$. Therefore an exothermic reaction

$E_{a0} = 5.3 \text{ kJ}$

(4)



$$\Delta H = 1299.5 \text{ kJ} - 787 \text{ kJ} - 285.8 \text{ kJ} = \boxed{226.7 \text{ kJ} = \Delta H}$$



$$\Delta S^\circ_{\text{reaction}} = \sum n S^\circ_{\text{products}} - \sum n S^\circ_{\text{reactants}} \Rightarrow$$

$$\Delta S^\circ_r = 2 (192.5 \text{ J/mol K}) - (3 \cdot 130.6 \text{ J/mol K} + 191.5 \text{ J/mol K})$$

$$\Delta S^\circ_r = 385 \text{ J/mol K} - 583.3 \text{ J/mol K} =$$

$$\boxed{\Delta S^\circ_r = -198.3 \text{ J/mol K}}$$