

1. Question part 1/3 | 9701 Feb-March 2024 P2 V2 Q1

1 Bismuth is an element in Group 15 of the Periodic Table.

(a) Bismuth has metallic bonding.

Draw a labelled diagram to show the metallic bonding in bismuth.

[1]

(b) Bismuth reduces water to form bismuth oxide, Bi_2O_3 . A colourless gas that ignites with a squeaky pop also forms.

(i) Construct an equation for the reduction of water by bismuth.

..... [1]

(ii) Bi_2O_3 is a yellow insoluble solid that melts at 1090 K. The molten compound conducts electricity.

Deduce the structure and bonding of Bi_2O_3 . Explain your answer.

.....
.....
..... [2]

(c) Bi_2O_3 can be used to form NaBiO_3 , as shown in equation 1.

equation 1 $\text{Na}_2\text{O} + \text{Bi}_2\text{O}_3 + \text{O}_2 \rightarrow 2\text{NaBiO}_3$

(i) Deduce the oxidation number of Bi in Bi_2O_3 and in NaBiO_3 .

oxidation number of Bi:

in Bi_2O_3 in NaBiO_3 [1]

(ii) Identify the reducing agent in equation 1.

..... [1]

- (d) NaBiO_3 is an oxidising agent with similar properties to KMnO_4 .

Fig. 1.1 shows an example of the use of NaBiO_3 as an oxidising agent.

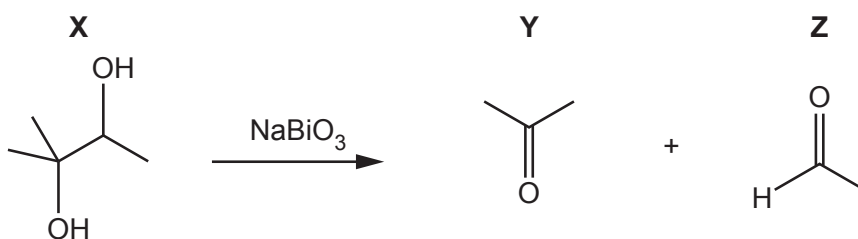


Fig. 1.1

- (i) Explain the term oxidising agent.

.....
 [1]

- (ii) Compound **X** forms when methylbut-2-ene reacts with KMnO_4 .

State the essential conditions for this reaction.

..... [1]

- (iii) Complete Table 1.1 to show what is observed when compounds **Y** and **Z** react separately with the named reagents.

Table 1.1

reagent	observation with Y	observation with Z
$\text{Na}_2\text{CO}_3(\text{aq})$	no reaction	
alkaline $\text{I}_2(\text{aq})$		
2,4-dinitrophenylhydrazine (2,4-DNPH)		
Tollens' reagent		

[4]

- (iv) Construct an equation for the reaction of **Z** with NaBH_4 .

Use $[\text{H}]$ to represent an atom of hydrogen from the reducing agent.

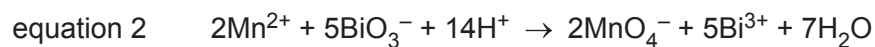
..... [1]

9701 Chemistry Paper 2 - Electrochemistry

Topical questions | 1 questions

1. Question part 3/3 | 9701 Feb-March 2024 P2 V2 Q1

- (e) NaBiO_3 can be used to determine the concentration of $\text{Mn}^{2+}(\text{aq})$. The ionic equation for the reaction is shown in equation 2.



A student uses the following procedure in an experiment.

- Add 100.0 cm^3 of a saturated solution of $\text{Mn}^{2+}(\text{aq})$ to a volumetric flask.
- Add distilled water to the flask to make a 1.00 dm^3 diluted solution.
- Titrate a 25.00 cm^3 sample of the diluted solution with 0.100 mol dm^{-3} $\text{NaBiO}_3(\text{aq})$.

The 25.00 cm^3 sample of the diluted solution of $\text{Mn}^{2+}(\text{aq})$ reacts completely with exactly 21.50 cm^3 of 0.100 mol dm^{-3} $\text{NaBiO}_3(\text{aq})$.

Calculate the concentration, in mol dm^{-3} , of $\text{Mn}^{2+}(\text{aq})$ in the saturated solution.

Show your working.

concentration of $\text{Mn}^{2+}(\text{aq})$ in the saturated solution = ... mol dm^{-3} [3]

[Total: 16]