AQA

Level 3 Certificate/Extended Certificate
APPLIED SCIENCE

Unit 1 Key Concepts in Science
Section B – Chemistry

Tuesday 11 June 2019   Afternoon   Time allowed: 1 hour 30 minutes. You are advised to spend approximately 30 minutes on this section.

Materials
For this paper you must have:
- a calculator
- Periodic Table
- Formulae Sheet.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in each section.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- You will be provided with a copy of the Formulae Sheet and Periodic Table.
- There are three sections in this paper:
  Section A – Biology   **Section B** – Chemistry   **Section C** – Physics.
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60 and the maximum mark for this section is 20.

Advice
Read each question carefully.

For Examiner's Use	
Question	Mark
1	
2	
3	
TOTAL	

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED**

Section B – Chemistry

Answer **all** questions in this section.

| 0 1 | Lithium carbonate is an important compound in the manufacture of lithium ion batteries.

| 0 1 |. 1 | Which block of the periodic table is lithium in?

Tick (✓) **one** box.

[1 mark]

d block ☐

f block ☐

p block ☐

s block ☐

| 0 1 |. 2 | 11.1 g of lithium carbonate (Li_2CO_3) was dissolved in water and made up to a volume of 250 cm^3

Calculate the number of moles of Li_2CO_3 in 11.1 g of lithium carbonate.

[2 marks]

Number of moles = _____

| 0 1 |. 3 | Calculate the concentration of the lithium carbonate solution.

[1 mark]

Concentration = _____ mol dm^{-3}

4

Turn over ▶

0 2   Cobalt is a transition element.

Cobalt compounds are often used to colour ceramics.

0 2 . 1   Complete the electron configuration of a cobalt atom.

[1 mark]

$1s^2 \ 2s^2$ _____

0 2 . 2   Some cobalt (II) compounds in solution are pink.

Explain why cobalt (II) compounds in solution are coloured.

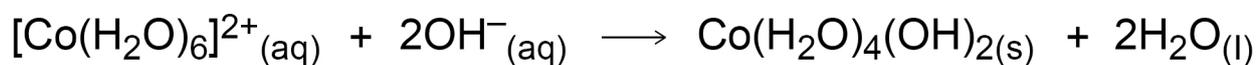Use the idea of electron transitions in your explanation.

[2 marks]

_____

_____

_____

_____

0 2 . 3   The chemical equation shows the addition of hydroxide ions to aqueous cobalt ions.

$$[Co(H_2O)_6]^{2+}{}_{(aq)} \ + \ 2OH^-{}_{(aq)} \ \longrightarrow \ Co(H_2O)_4(OH)_{2(s)} \ + \ 2H_2O_{(l)}$$

What type of reaction is this?
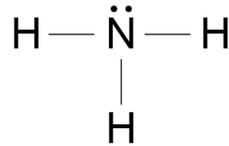
[1 mark]

_____

4

0 3   Ammonia (NH_3) is used to manufacture dyes, explosives and fertilisers.

0 3 . 1   The nitrogen and hydrogen atoms in an ammonia molecule are joined by single covalent bonds.

Figure 1 shows an ammonia molecule.

Figure 1

$$H\!-\!\overset{\cdot\cdot}{N}\!-\!H$$
$$|$$
$$H$$

Describe a covalent bond.

[2 marks]

_____

_____

_____

0 3 . 2   Ammonia is a gas at room temperature and pressure.

Explain why ammonia has a low boiling point.

[2 marks]

_____

_____

_____

_____

0 3 . 3   Substances that have a low boiling point are often described as volatile.

What is meant by the term volatile?
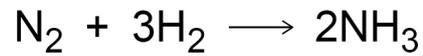
[1 mark]

_____

_____

Question 3 continues on the next page

Turn over ▶

Chemical engineers are responsible for monitoring all aspects of any large-scale production.

Ammonia is produced on a large scale from nitrogen and hydrogen.

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

Mean bond enthalpies can be used to calculate enthalpy changes.

0 3 . 4 Describe what is meant by the term 'mean bond enthalpy'.

[2 marks]

_____

_____

_____

_____

0 3 . 5 Why do calculations of enthalpy changes using mean bond enthalpies not give accurate values?

[1 mark]

_____

_____

| 0 | 3 |.| 6 | **Table 1** shows some mean bond enthalpy data.

Table 1

Bond	$N \equiv N$	$H - H$	$N - H$
Mean bond enthalpy / kJmol^{-1}	945	436	390

Calculate the enthalpy of formation of ammonia.

Use the data given in **Table 1**.

[4 marks]

Enthalpy of formation of ammonia = _____ kJmol^{-1}

12

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

Question number	Additional page, if required. Write the question numbers in the left-hand margin.

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