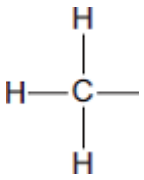
C3b (2) QUESTIONS

1. This question is about organic compounds.

(a) Wine contains ethanol ($CH_3CH_2OH$).

(i) Complete the displayed structure of ethanol.



**(1)**

(ii) Wine left in a glass for several days turns sour.
The sour taste is caused by ethanoic acid.

Complete the sentences.

The ethanoic acid is produced from a reaction between ethanol

and ..... .

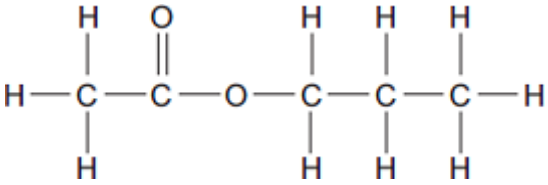
This type of reaction is ..... .

**(2)**

(b) Propyl ethanoate, a fragrance, can be produced by reacting ethanoic acid with an alcohol.

Propyl ethanoate is a member of a series of organic compounds. The members of the series all have the same functional group.

The displayed structure of propyl ethanoate is:



(i) Draw a ring around the functional group for this series on the displayed structure of propyl ethanoate.

**(1)**

(ii) Name the series of organic compounds with this functional group.

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**(1)**

(iii) The alcohol used to make propyl ethanoate has the formula $CH_3CH_2CH_2OH$

Name this alcohol.

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**(1)**
**(Total 6 marks)**

2. John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.
He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.
Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

| | | | | | | |
|---|---|---|---|---|---|---|
| **H** | **Li** | **G** | **Bo** | **C** | **N** | **O** |
| **F** | **Na** | **Mg** | **Al** | **Si** | **P** | **S** |
| **Cl** | **K** | **Ca** | **Cr** | **Ti** | **Mn** | **Fe** |
| **Co, Ni** | **Cu** | **Zn** | **Y** | **In** | **As** | **Se** |
| **Br** | **Rb** | **Sr** | **Ce, La** | **Zr** | **Di, Mo** | **Ro, Ru** |
| **Pd** | **Ag** | **Cd** | **U** | **Sn** | **Sb** | **Te** |
| **I** | **Cs** | **Ba, V** | **Ta** | **W** | **Nb** | **Au** |
| **Pt, Ir** | **Tl** | **Pb** | **Th** | **Hg** | **Bi** | **Os** |

**Newlands' periodic table**

(a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

1 .....

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2 .....

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**(2)**

(b) Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.
Use the Newlands' periodic table above to help you to answer this question.

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**(3)**

(c) State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

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**(2)**
**(Total 7 marks)**

3. These labels have been taken from two bottles of spring water.

**Mountain View**

*Natural Spring Water*

*Contains essential minerals for good health*

**Analysis**

| Ions present | mg/dm$^3$ |
|---|---|
| Calcium | 65 |
| Magnesium | 35 |
| Potassium | 5 |
| Sodium | 12 |
| Chloride | 9 |
| Hydrogencarbonate | 269 |
| Sulfate | 21 |

Also tested by the independent Food Standards Agency and approved safe.

**Valley Croft**

***Pure Spring Water***

***With healthy minerals as Nature intended***

**Analysis**

| Ions present | mg/dm$^3$ |
|---|---|
| Calcium | 16 |
| Magnesium | 14 |
| Potassium | 5 |
| Sodium | 34 |
| Chloride | 13 |
| Hydrogencarbonate | 62 |
| Sulfate | 7 |

Pure and natural – contains no chemicals.

Tested in our own laboratories by our own scientists to keep you safe.

(a) Mountain View and Valley Croft spring waters are hard because they contain calcium and magnesium ions.

(i) Mountain View spring water is about **three** times as hard as Valley Croft spring water.

Use the information on the labels to explain why.

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**(2)**

(ii) Describe how a student could use soap solution to show that Mountain View spring water is about **three** times as hard as Valley Croft spring water.

You should state how the experiment is made fair and give the expected result.

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**(3)**

(b) Why is hard water good for health?

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**(1)**

(c) Give **one** disadvantage of hard water.

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**(1)**

(d) (i) Suggest why people should be concerned about the claim that Valley Croft spring water "contains no chemicals".

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**(1)**

(ii) Suggest why people should be concerned that Valley Croft spring water has only been tested by their own scientists.

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**(1)**

**(Total 9 marks)**

4. (a) Ethanol is an alcohol. The structural formula of ethanol is $CH_3CH_2OH$.

(i) Draw the displayed structure of ethanol, showing all the bonds.

**(1)**

(ii) Ethanol reacts with sodium to produce a gas.

What is the gas produced in this reaction?

.....

**(1)**

(b) (i) The structural formula of ethanoic acid is $CH_3$ COOH.

Dilute solutions of ethanol can be converted into dilute solutions of ethanoic acid.

Use a word from the box to complete the sentence.

| | | |
|---|---|---|
| **neutralised** | **oxidised** | **reduced** |

In this reaction the ethanol is ..... .

**(1)**

(ii) What is the common name for a dilute solution of ethanoic acid?

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**(1)**

(iii) What is the functional group in ethanoic acid?

.....

**(1)**

(c) Ethanoic acid reacts with propanol to give propyl ethanoate, $CH_3COOCH_2CH_2CH_3$

(i) What type of organic compound is propyl ethanoate?

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**(1)**

(ii) Suggest a use for propyl ethanoate.

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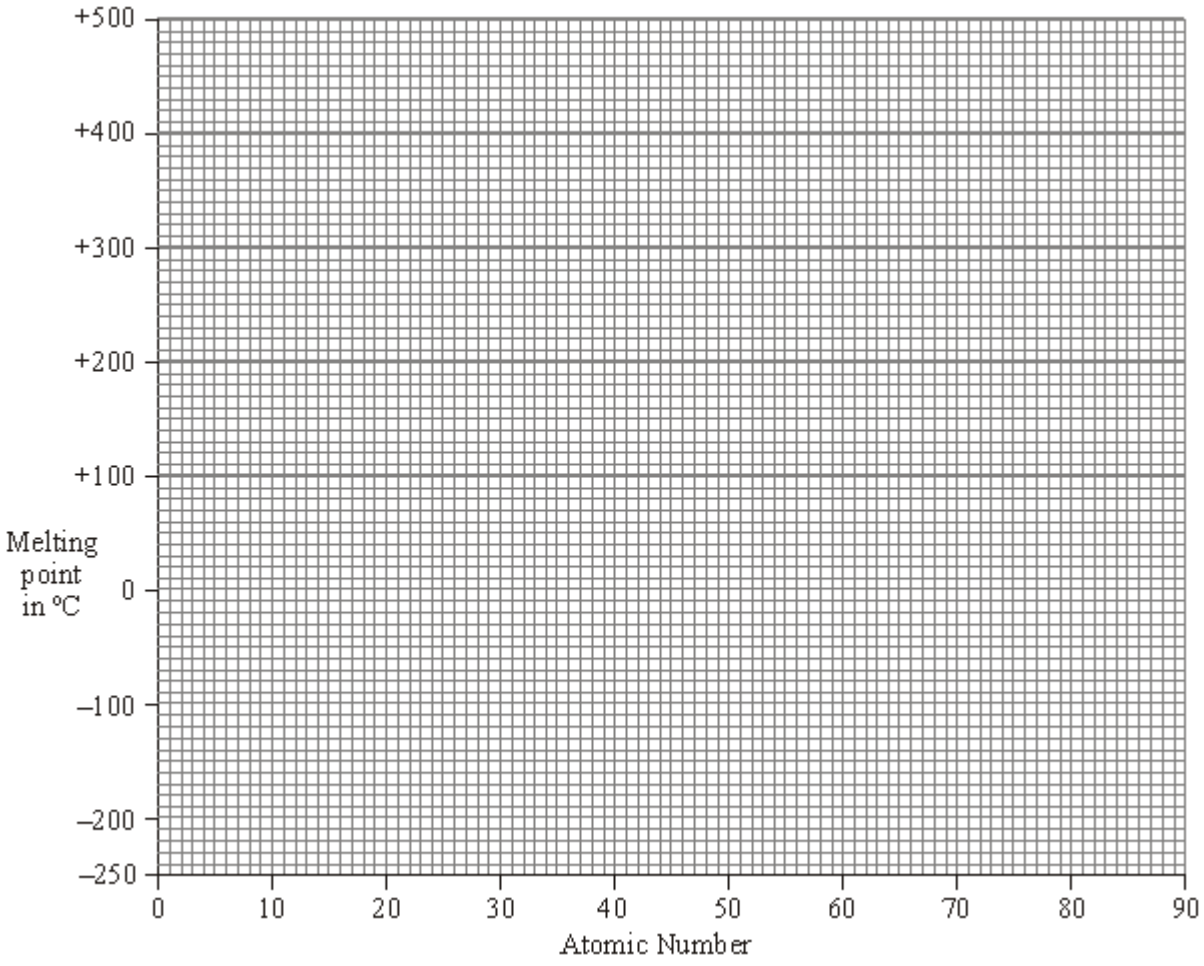
**(1)**

**(Total 7 marks)**

5. (a) The table gives the melting points of some of the elements of Group 7.

| Element | Atomic number | Melting point in ºC |
|---|---|---|
| Fluorine | 9 | –220 |
| Chlorine | 17 | –101 |
| Bromine | 35 | –7 |
| Iodine | 53 | 114 |
| Astatine | 85 | ? |

(i) Plot a graph of the melting point against atomic number.




Draw a line of best fit.
Extend your line to estimate a value for the melting point of astatine.

**(2)**

(ii) Estimate the melting point of astatine. ..... °C

**(1)**

(iii) Which of the Group 7 elements are solids at 20 °C?

.....

**(1)**

(b) (i) Draw a diagram to show the arrangement of electrons in an atom of fluorine.

**(1)**

(ii) The elements of Group 7 have similar chemical properties.

Explain, in terms of electrons, why they have similar chemical properties.

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**(1)**

(c) Xenon is a very unreactive element.

(i) Explain, in terms of electrons, why xenon is so unreactive.

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**(2)**

(ii) Fluorine reacts with xenon but iodine does not.

Explain, in terms of atomic structure, why fluorine is more reactive than iodine.

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**(3)**

**(Total 11 marks)**

6. Most water contains dissolved compounds.

The concentrations of these dissolved compounds are higher in sea water than in drinking water.

(a) (i) Draw a ring around the correct answer to complete the sentence.

Pure water can be obtained from sea water by

| |
|---|
| distillation. |
| filtration. |
| neutralisation. |

**(1)**

(ii) What is the boiling point of pure water? ..... °C

**(1)**

(b) A student wanted to find out how much solid was dissolved in sea water.

This is the method the student used:

- measure the mass of an empty evaporating basin
- measure 25 $cm^3$ of sea water and pour it into the evaporating basin
- heat the evaporating basin gently until all of the water has evaporated
- measure the mass of the evaporating basin containing the solid residue.

(i) What piece of apparatus would be suitable for measuring 25 $cm^3$ of sea water?

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**(1)**

(ii) How could the student check that all of the water had evaporated?

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**(2)**

(iii) The results the student obtained using 25 $cm^3$ of sea water are:

mass of empty evaporating basin = 23.21 g
mass of evaporating basin and dry solid residue = 24.04 g

Calculate the mass of solid dissolved in 1000 $cm^3$ of the sea water.

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Mass dissolved in 1000 $cm^3$ = ..... g

**(2)**

(c) In many countries chlorine is added to drinking water supplies.

Why is chlorine added to drinking water?

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**(1)**

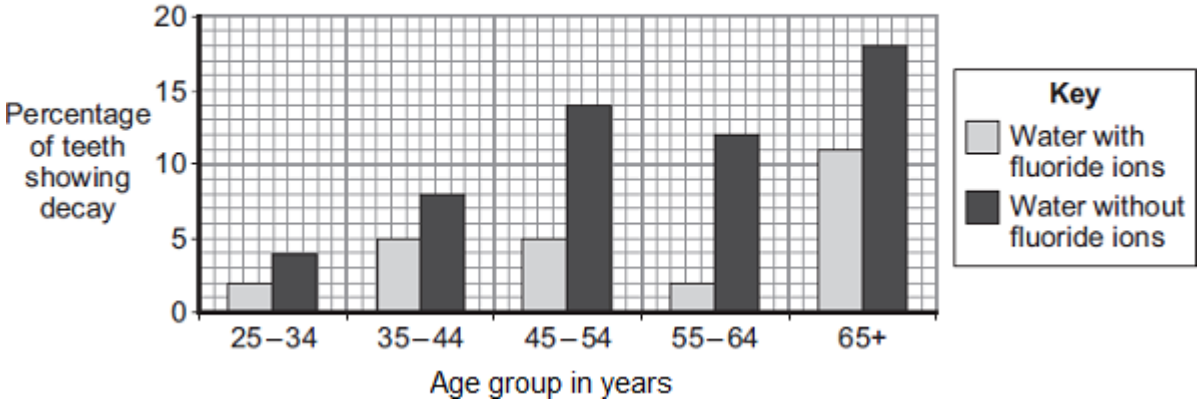
(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Compounds containing fluoride ions are added to some drinking water supplies.

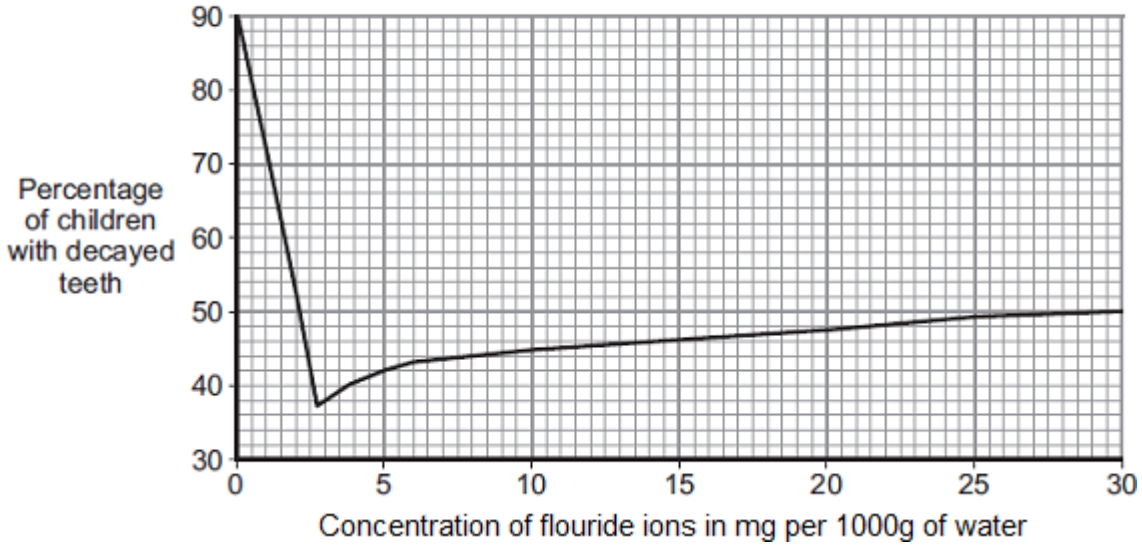
Many scientists have done research into the effects of fluoride ions in drinking water.

**Graphs 1**, **2** and **3** show some of the results obtained.

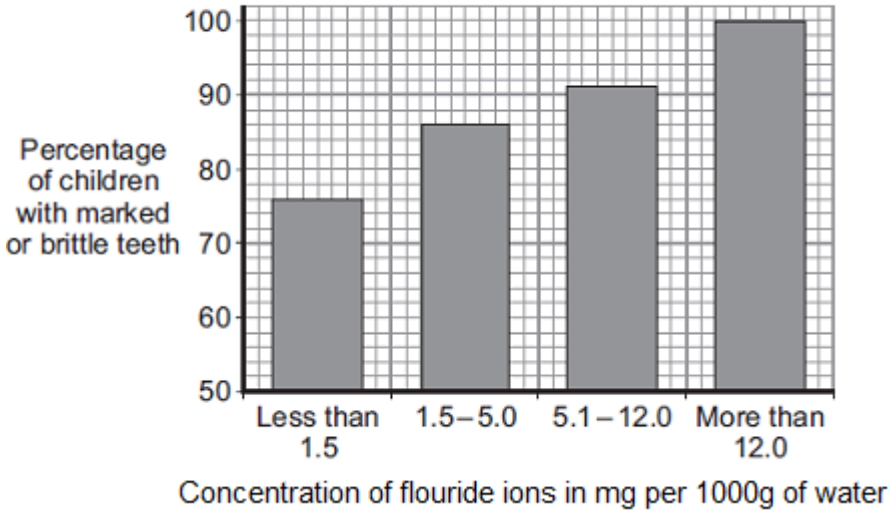
**Graph 1**




**Graph 2**



**Graph 3**




Evaluate the advantages and disadvantages of adding fluoride ions to drinking water.

You should support your answer with evidence from **all three** graphs.

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**(6)**
**(Total 14 marks)**