1 Radiation comes from the nucleus of an atom that is unstable.

(a) An alpha particle is a helium nucleus.

What is a beta particle?

Choose the **best** answer from

an electron

a fast moving electron

a proton

a fast moving proton

..... **[1]**

(b) What happens to a nucleus when a beta particle is emitted?

Put ticks (✓) next to the **two** correct statements.

mass number is unchanged	☐
nucleus has one more neutron	☐
nucleus has one more proton	☐
atomic number decreases by one	☐

[1]

(c) Radioactive americium (Am) is used in smoke alarms.

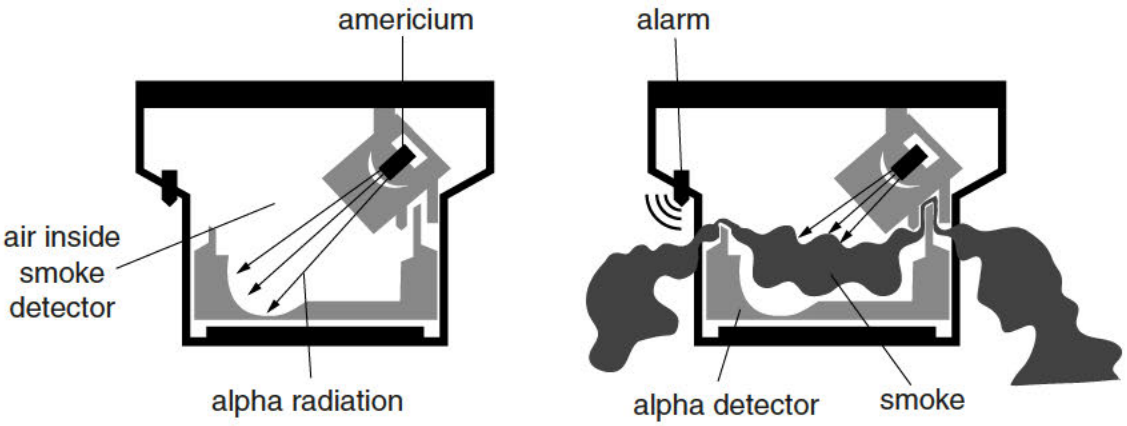
(i) Complete the equation for alpha decay.

An alpha particle is a helium nucleus.

$$^{241}_{95}\text{Am} \rightarrow {}^{\ldots\ldots}_{\ldots\ldots}\text{Np} + {}^{\ldots\ldots}_{\ldots\ldots}\text{He}$$

[2]

(ii) Here are two diagrams showing how a smoke detector works.



Use the diagrams to describe how a smoke detector works.

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

2 Roxanne investigates the density of different materials.

She calculates the density using this equation:

$$\textbf{density (in g/cm}^3\textbf{)} = \frac{\textbf{mass}}{\textbf{volume}}$$

Look at her results.

Material	State	Volume in cm^3	Mass in g	Density in g/cm^3
Water	liquid	1.0	1.0	1.0
Glass	solid	3.0	5.8	
Liquid X	liquid	1.0	1.2	1.2
Oil	liquid	3.0		0.9
Liquid Y	liquid	1.0	0.7	0.7
Liquid Z	liquid	1.0	0.8	0.8

(a) Calculate the density of glass.

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.....

answer ..... g/cm^3 **[1]**

(b) Roxanne has lost the measurement for the mass of oil.

Calculate the mass of oil.

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.....

answer ..... g **[2]**

(c) Roxanne experiments with different liquids from the table.

She has two identical beakers and puts one litre of water into each of them.

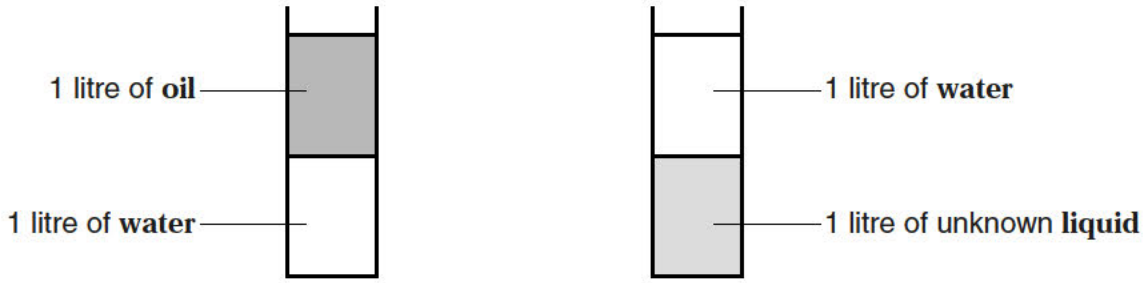
She puts one litre of oil into beaker **A**.

The oil floats on the water because of their densities.

Roxanne puts one litre of another of the liquids into beaker **B**.

The liquids do **not** mix together.

Look at the diagrams.



Which beaker of liquids is heavier, **A** or **B**?

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Explain your answer and suggest which liquid from the table is the **unknown liquid**.

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[3]

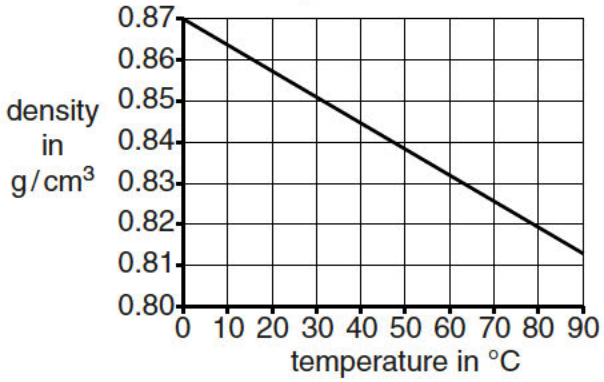
(d) The state of water is affected by temperature.

Water freezes and becomes ice at 0 °C.

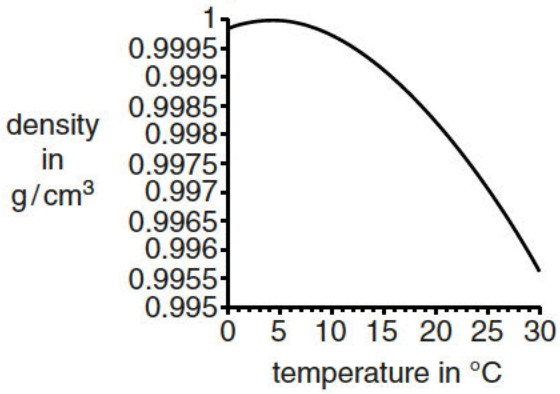
The density of liquids is also affected by temperature.

Look at the graphs for oil and water.

Graph for oil



Graph for water



(i) Describe how the density varies with temperature for **oil**.

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..... **[1]**

(ii) Describe how the density varies with temperature for water.

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..... [1]

(iii) Water freezes at 0 °C and ice floats on water. The density of ice is 0.92 g/cm^3 at 0 °C.

Use the data in the graph for water to explain why ice floats on water, and suggest how this protects fish at the bottoms of lakes which have frozen over.

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..... [2]

[Total: 10]