Questions are for both separate science and combined science students unless indicated in the question

Q1.

This question is about burning fuels in central heating boilers.

In the future, gas central heating boilers may burn hydrogen rather than natural gas.

The table below shows information about these fuels when 1 dm^3 of the fuel is burned in a central heating boiler.

	Fuel	
	Hydrogen	**Natural gas**
Energy released in kJ	11.9	37.1
Mass of carbon dioxide produced in grams	0.00	1.83
Mass of water vapour produced in grams	0.75	1.50
Mass of oxides of nitrogen produced in grams	6.6×10^{-4}	4.9×10^{-4}

(a) Explain how oxides of nitrogen are produced when burning fuels.

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_____

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_____

(2)

(b) Explain **one** positive impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use the table above.

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(2)

(c) Explain **one** negative impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use the table above.

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(2)

(d) Air is 20% oxygen.

Calculate the volume of air needed to provide enough oxygen to react with 3.50 dm^3 of hydrogen gas. **(chemistry only) (HT only)**

The equation for the reaction is

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

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Volume of air = _____ dm^3

(3)

(e) Central heating boilers can also burn kerosene.

Kerosene is produced from crude oil in a fractionating column using fractional distillation.

In the first step, crude oil is heated and hydrocarbon vapours are formed.

Explain how kerosene is produced from these hydrocarbon vapours.

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(3)

(Total 12 marks)

Q2.

This question is about greenhouse gases and climate change.

Carbon dioxide and methane are greenhouse gases.

(a) Which of the following is also a greenhouse gas?

Tick (✓) **one** box.

Chlorine ☐

Nitrogen ☐

Oxygen ☐

Water vapour ☐

(1)

In the past 50 years, there has been an increase in:

- the world population
- the concentration of carbon dioxide in the atmosphere
- the concentration of methane in the atmosphere
- the mean temperature of the atmosphere at the Earth's surface.

Most scientists think this information can be used to explain climate change.

(b) Explain why the increase in world population may have caused the increase in the concentration of carbon dioxide in the atmosphere.

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_____

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_____

(2)

(c) Explain why the increase in world population may have caused the increase in the concentration of methane in the atmosphere.

_____

_____

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(2)

(d) Describe **two** potential effects of the increase in the mean temperature of the atmosphere at the Earth's surface.

1 _____

_____

2 _____

_____

(2)

(e) The mean temperature of the atmosphere at the Earth's surface has increased.

Most scientists think that this has been caused by an increase in the concentration of greenhouse gases in the atmosphere.

Give **one** reason why some scientists do **not** accept this theory.

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(1)

(Total 8 marks)