

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE  
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU  
Tystysgrif Gyffredinol Addysg Uwchradd

652/02

**GCSE IN APPLIED SCIENCE (Double Award)**

**Unit 2: Science for the Needs of Society**

**HIGHER TIER (Grades D-A\*)**

P.M. FRIDAY, 19 January 2007

(1 hour 30 minutes)

<b>For Examiner's use only</b>	
<b>Section A</b>	
<b>Section B</b>	
<b>Total</b>	

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

You are reminded to show all your working. Credit is given for correct working even when the final answer given is incorrect.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

**SECTION A (40 marks)**

*Answer all the questions in the spaces provided.*

- 1. A nurse is learning how to monitor the heart of a patient.



The nurse will be able to tell if all the chambers of the heart are working properly.

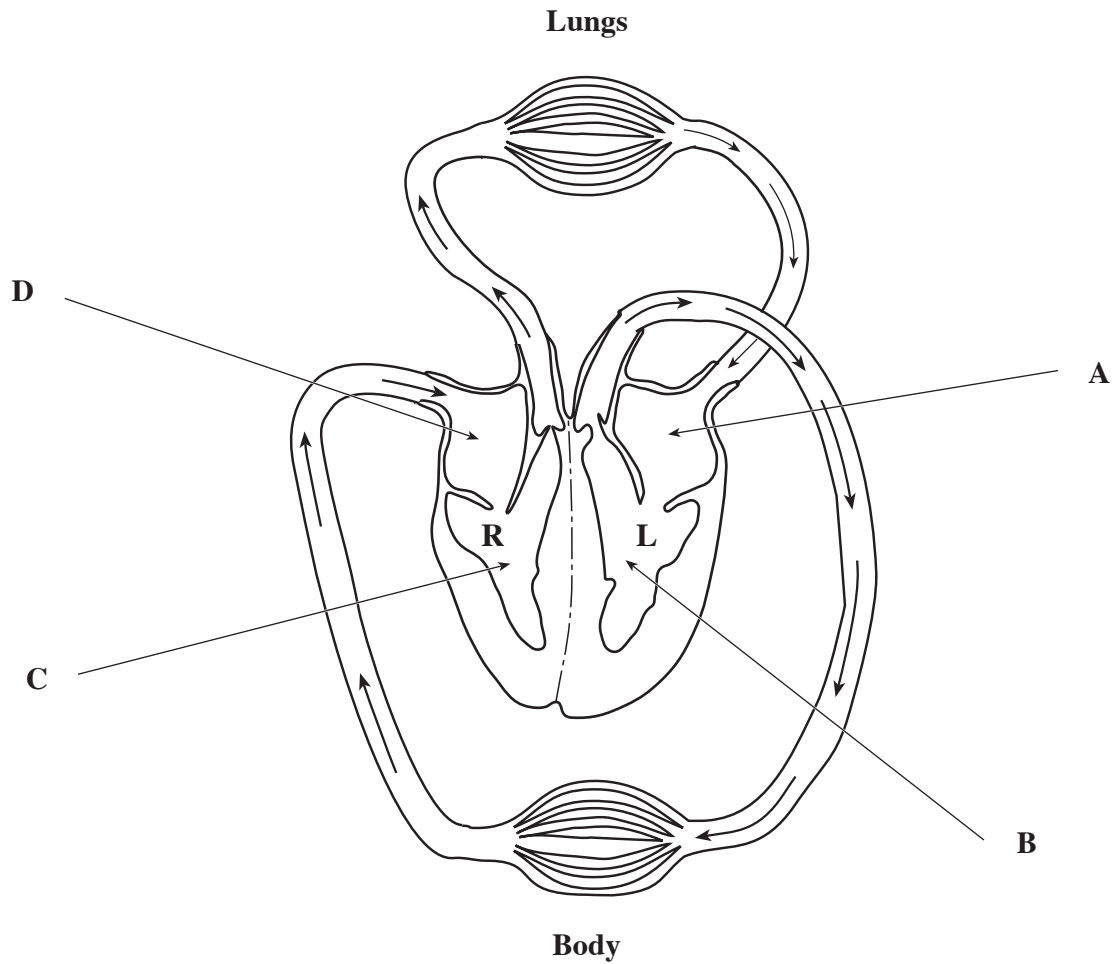
- (a) The nurse learns that the heart consists of four chambers, two on the right side and two on the left side.

**Name the two chambers on the right side of the heart.**

[2]

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(b) Look at the diagram of the circulation system below and answer the questions that follow.



- (i) Which chamber, **A**, **B**, **C** or **D** pumps blood to the lungs? ..... [1]
- (ii) Into which chamber, **A**, **B**, **C** or **D** does blood return from the body? ..... [1]
- (iii) The nurse learns that symptoms of tiredness, shortness of breath and irregular heart rate may mean there is left ventricular failure.  
Which chamber **A**, **B**, **C** or **D** is the left ventricle? [1]  
.....
- (iv) **Add** an arrow labelled **V** to the diagram to show a vein. [1]

(c) The nurse takes a blood sample from the patient.  
This is sent to the laboratory for testing.

(i) It is found that the number of red blood cells in the blood is too low.  
Give **one** reason why this will cause the patient to get tired easily. [1]

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(ii) The number of white blood cells present is normal.  
Why does your body need white blood cells? [1]

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(iii) The number of platelets in the blood is low.  
Give **one** reason why this may be a problem if the patient cuts himself. [1]

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2. Our digestive system contains many types of bacteria.  
Some types of these are called ‘friendly’ bacteria.  
Some people think that these ‘friendly’ bacteria keep us healthy.  
The dairy industry makes **probiotic** drinks that contain live ‘friendly’ bacteria.  
They claim that these drinks are good for us.

(a) One advert claims that people should take **probiotic** drinks especially after they have been on antibiotics for a time.

(i) **State** what will happen to the number of bacteria in the digestive system when taking antibiotics. [1]

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(ii) Give **one** reason for your answer. [1]

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(iii) **Explain** why the advert claims that you should take probiotic drinks after taking antibiotics. [1]

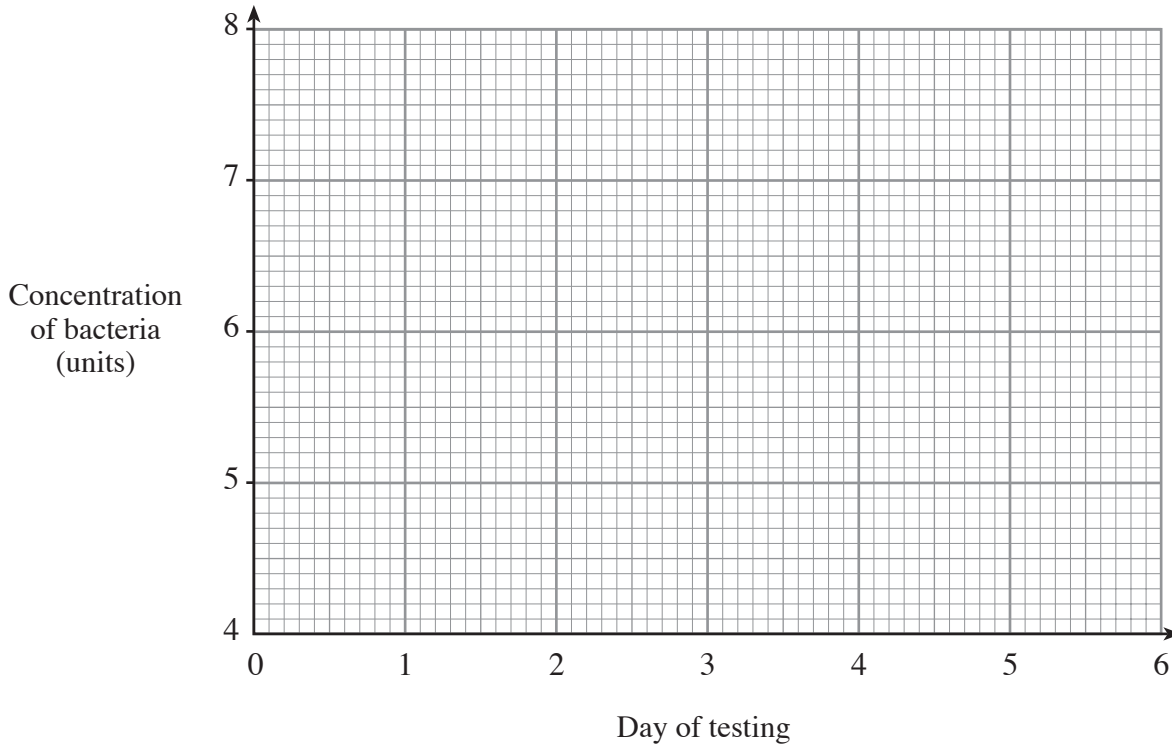
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- (b) Some scientists claim that the bacteria in **probiotic** drinks will not survive in the stomach. The dairy industry claim that not only will the bacteria survive, but their numbers will increase.  
Science technicians working for a dairy producer are asked to investigate which claim is correct.  
They produce a model of the stomach and add live bacteria that are found in the **probiotic** drink.  
They measure the bacteria concentration for five days.  
The results are shown below.

Day of testing	Concentration of bacteria (units)
1	5.0
2	6.4
3	4.8
4	5.6
5	4.8

- (i) Plot these points on the grid **and** join them together from point to point. [3]



- (ii) Some scientists claimed the bacteria would not survive.  
**Explain** whether the results agree with this claim. [2]

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- (iii) The dairy industry claimed that the number of bacteria would increase.  
**Explain** whether the results agree with this claim. [2]

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- (c) It is important that harmful bacteria do not get into the probiotic drinks when they are being produced.  
State **two** methods of making sure this does not happen. [2]

1. ....

2. ....

3. The table below shows information about some alloys of iron.

Alloy	Made from	Properties
Mild steel	99.8% iron 0.2% carbon	Easily pressed into shape
High carbon steel	98% iron 1.7% carbon 0.3% manganese	Hard but brittle
Manganese steel	85% iron 1.2% carbon 13.8% manganese	Very hard
Stainless steel	74% iron 0.3% carbon 18% chromium 7.7% nickel	Rust resistant

(a) All the alloys shown contain carbon and iron.

Iron is a metal; carbon is a non-metal.

Give **two** properties of metals that are different from non-metals. [2]

1. ....

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2. ....

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(b) Use the information in the table to answer the questions below:

(i) **Name** the most suitable alloy for making kitchen sinks. .... [1]

(ii) Why is high carbon steel **not** suitable for making car bodies? [1]

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(c) Which elements have been added to iron to make it rust resistant? [2]

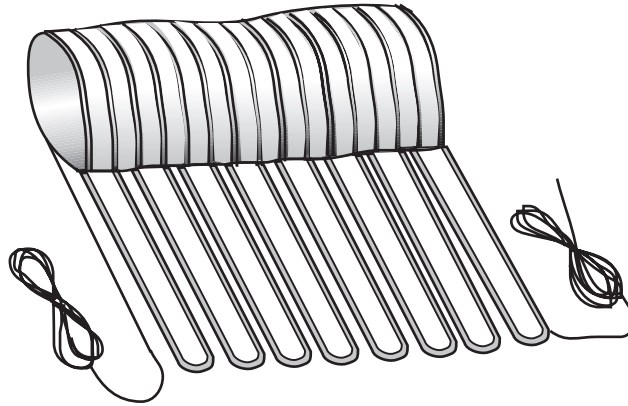
..... **and** .....



4. Manufacturers make products from mixing solids, liquids and gases together. There are different types of mixtures. Complete the sentences below.

- (i) Bleach is a solution. It is a mixture made from dissolving a .....  
in a ..... [2]
- (ii) Whipped cream is a mixture made from a .....  
and a ..... [2]
- (iii) Tiny droplets of one liquid mixed with another liquid is an example of  
an ..... [1]
- (iv) In a suspension, the ..... has not dissolved in  
the ..... [2]

5. A new version of heating the home is available for homeowners. It is made from metal ribbons that can be laid under carpets.



The suppliers claim it will be cheaper than using other types of heating.

- (a) When being tested, the metal ribbons were connected to a 230 V mains supply. The current through the ribbons was 0.5 A.
- (i) Write down in words an equation connecting power, current and voltage. [1]
- .....
- (ii) Calculate the power developed in the ribbons. [2]
- Power = ..... W
- (b) The number of ribbons required to heat a room would produce a power of **1500 W**. Calculate the cost of using this form of ribbons for **6 hours**. [3]
- Assume one unit of electricity costs **8p**.  
You may use the following equations:

$$\text{Energy used (kWh)} = \text{power (kW)} \times \text{time (h)}$$

$$\text{Total cost (p)} = \text{energy used (kWh)} \times \text{cost per unit (p)}$$

Total cost = ..... p

**SECTION B (60 marks)**

Answer **all** the questions in the spaces provided.

6. The table shows the energy produced by using different methods of generating electricity in the UK between 1970 and 2000.

Energy production (in units called exajoules)

Method	1970	1975	1980	1985	1990	1995	2000
natural gas	0.5	1.6	2.0	2.3	2.5	3.1	4.3
oil	4.2	3.8	3.4	3.3	3.5	3.4	3.4
coal	4.5	3.3	3.3	2.9	3.0	2.2	1.7
nuclear	0.3	0.4	0.4	0.7	0.8	1.0	0.9
wind	0.0	0.0	0.0	0.0	0.0	0.1	0.1
hydroelectric	0.02	0.01	0.01	0.02	0.02	0.01	0.02

- (a) (i) **Calculate** the increase in energy production from 1970 to 2000. [3]

Increase in energy production = ..... exajoules

- (ii) **Describe** what has happened to the energy production caused by burning fossil fuels between 1970 and 2000. [2]

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- (b) (i) At present, the bulk of our electricity is produced by burning gas. Give **two** reasons why this should be reduced. [2]

1. ....

2. ....

- (ii) Some of our nuclear power stations are nearing the end of their useful lives. **Explain** why it is very expensive to shut down a nuclear power station. [3]

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7. The farming industry uses selective breeding to produce offspring with certain characteristics. The breeding of chickens is one example. It is important that chickens have strong leg joints. Before being used for breeding, a chicken's legs are examined.



After a number of breeding cycles, all offspring will have strong leg joints. The gene for strong legs (**S**) is dominant to the gene for weak legs (**s**).

- (a) In the first breeding cycle, a cockerel with homozygous genes for strong legs was crossed with a hen with homozygous genes for weak legs. Using a Punnett square, show the gene pairs of the offspring produced in the first breeding cycle. [2]

(b) Two offspring from the first breeding cycle were then used for the second breeding cycle.

(i) Complete a Punnett square to show the gene pairs for the new offspring. [3]

(ii) What fraction of chickens from this breeding cycle would be used for future breeding? [1]

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(c) The sperm cells from the cockerel, and the eggs from the hen, are produced by meiosis. **Describe** the stages in meiosis. [3]

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8. An athlete's reaction to exercise is being tested by her health care team consisting of a physiotherapist, nurse and laboratory technician.



- (a) The air breathed in, and breathed out, by the athlete was analysed. The analysis is shown below.

Gas	% in air breathed in	% in air breathed out
Nitrogen	78.00	78.00
Oxygen	21.00	17.00
Carbon dioxide	0.03	4.03
Other gases	0.97	0.97

**Explain** why the gas content of the air breathed out is different from the air breathed in. [3]

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- (b) The athlete's breathing rate was monitored by the physiotherapist before, during, and after exercise.

The results are shown in the table below.

When breathing rate was measured	Before exercise	During exercise	1 minute after exercise	3 minutes after exercise	5 minutes after exercise
Breathing rate (breaths/minute)	17	72	35	22	17

- (i) **Explain** why her breathing rate increases during exercise. [2]

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- (ii) After a period of sprinting on the treadmill, the athlete complains her muscles are tired and aching. **Explain** why this happens. [2]

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- (iii) **Explain**, why the breathing rate takes a few minutes to return to normal. [2]

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- (c) The nurse took a blood sample before, and after, the athlete exercised. The laboratory technician analysed the blood glucose level. It was found that the blood glucose level had dropped. **Describe** the changes that occur inside the athlete's body to bring the glucose level back to normal. [3]

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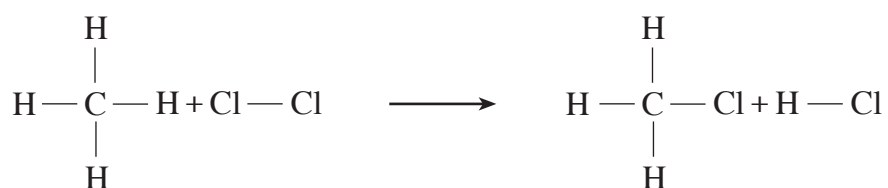
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9. Chlorinated methane ( $\text{CH}_3\text{Cl}$ ) is used in the manufacture of special chemicals and pharmaceuticals.

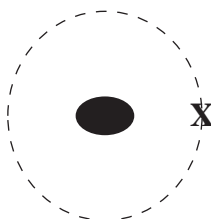
If methane gas is mixed with chlorine gas, and exposed to sunlight, an explosive reaction takes place.

Chlorinated methane and hydrogen chloride are produced.

The reaction is described by the equations below.



- (a) (i) Hydrogen has an atomic number of 1. It has an electronic structure as shown in the diagram, where **X** represents an electron.



The atomic number of carbon is 6. Draw a diagram in the space below to show the electronic structure of a carbon atom. [2]



- (ii) In methane, the carbon and hydrogen atoms are held together by covalent bonds. Draw **and** label a diagram to show how covalent bonds are made in a methane molecule. [2]

- (b) Give **one** reason why methane is classed as an organic compound. [1]

- (c) The bond energies in the reaction above are given in this table.

Bond	Bond Energy (kJ)
C — H	413
Cl — Cl	243
C — Cl	339
H — Cl	430

- (i) **Calculate** the energy required to break the bonds in the reaction. [3]

Energy = ..... kJ

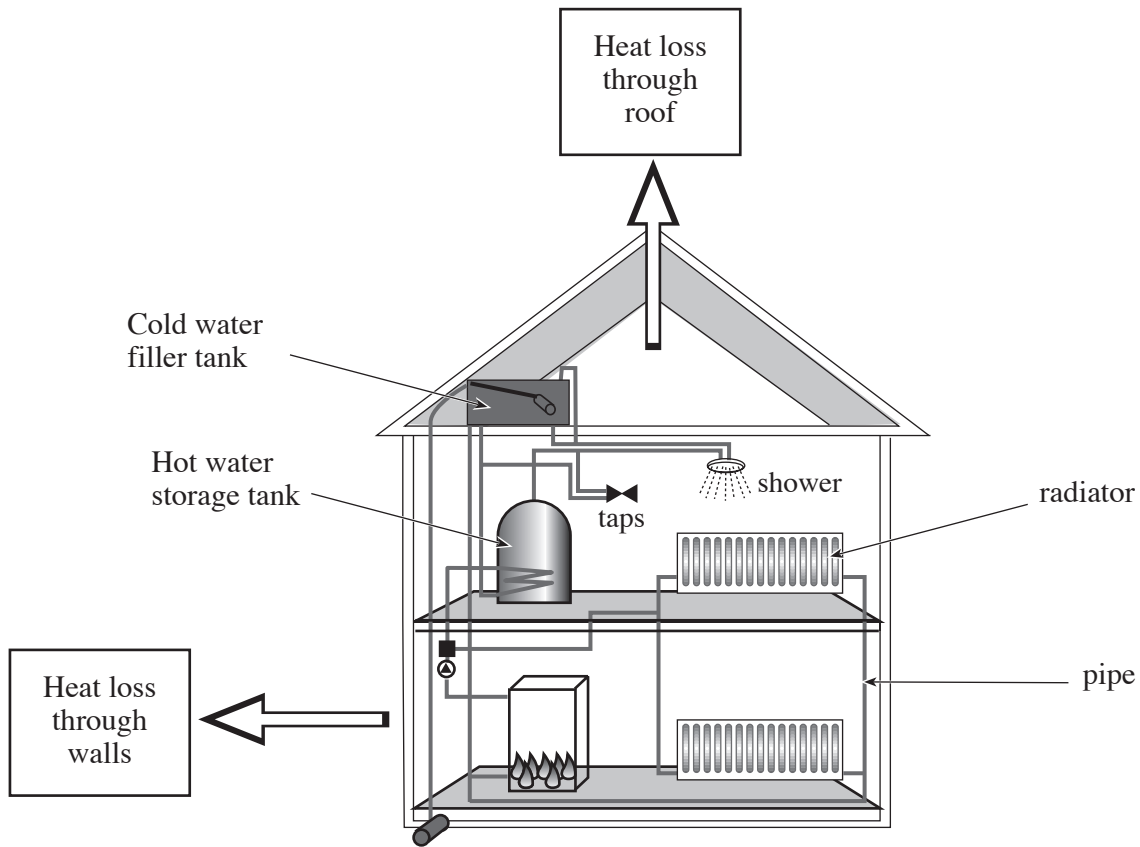
- (ii) **Calculate** the energy released when the products are formed. [3]

Energy = ..... kJ

- (iii) **State** whether this is an example of an exothermic or endothermic reaction, and give **one** reason for your answer. [2]

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10. The diagram shows the central heating system in a house and some areas where heat is lost.



(a) (i) The hot water storage tank is wrapped in a fibre filled jacket with a white outer cover. **Explain** how this reduces the heat loss from the tank. [3]

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(ii) **Describe** how heat is lost from the upstairs rooms in the house through the roof. [3]

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(iii) Give **one** method of reducing heat loss through the walls. [1]

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- (b) (i) The water is heated by a gas fired boiler. Some of this heated water flows through pipes to the radiators, and some runs through pipes in the storage tank to warm the water. The **efficiency of this central heating system is 55%**.  
**Explain** what is meant by the statement in bold. [2]

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- (ii) The homeowner is advised that the heating system could be made more efficient by removing the hot water storage tank and using a boiler that delivers hot water directly to the taps when needed. **Suggest** why this would make the system more efficient. [2]

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(c) Different materials are used in different parts of the system.

- (i) The metal copper is used to make the pipes and the hot water tank, and the metal steel is used to make the radiators. One reason metals are used for these parts is because metals are malleable.  
**Explain** in terms of atomic structure, why metals are malleable. [2]

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- (ii) The cold water filler tank is made from high density poly(e)thene and some of the pipes are wrapped in insulating tubes made from polyethylene. Both of these are polymers.

1. Describe the molecular structure of polymers. [2]

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2. Polyethylene is flexible but high density poly(e)thene is not. In terms of molecular structure, give **one** reason for this difference in behaviour. [1]

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