

Specimen Paper

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education
Higher Tier

Science A 1 Unit 5

H

For this paper you must have:

- a ruler
- the Chemistry Data Sheet (enclosed)
- the Physics Equation Sheet (enclosed).

You may use a calculator.

Time allowed

- 90 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 7(c) should be answered in continuous prose.
In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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13	
14	
TOTAL	

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

Biology Questions

- 1** Many diseases are caused by viruses. Children are given vaccines to protect them against viral disease.

- 1 (a)** Explain how vaccination protects a child against a viral disease.

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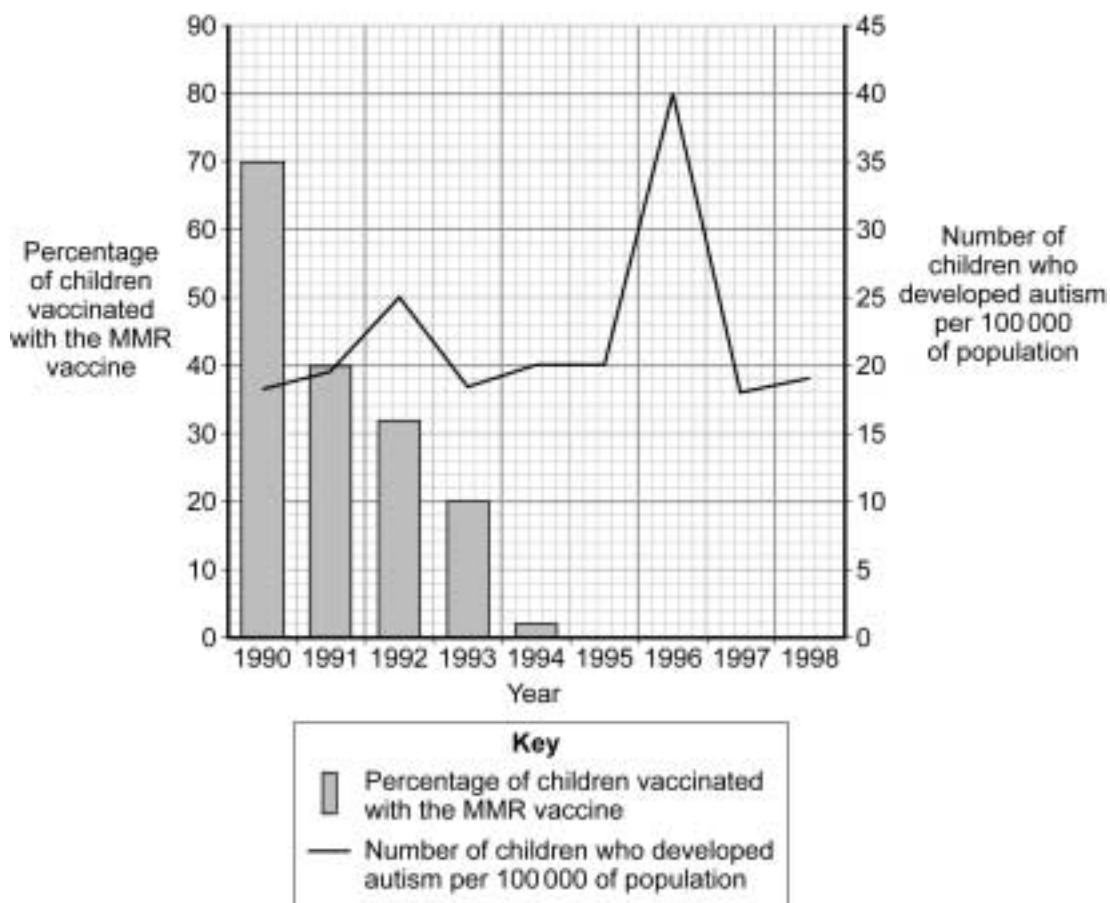
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(3 marks)

- 1 (b)** In the 1990s many people thought that the MMR vaccine caused autism in some children. This is why the Japanese government stopped using the MMR vaccine.

The graph gives information about the percentage of Japanese children who developed autism during the 1990s.



The data in the graph support the view that there is **no** link between MMR vaccination and autism.

Explain why.

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(4 marks)

7

Turn over for the next question

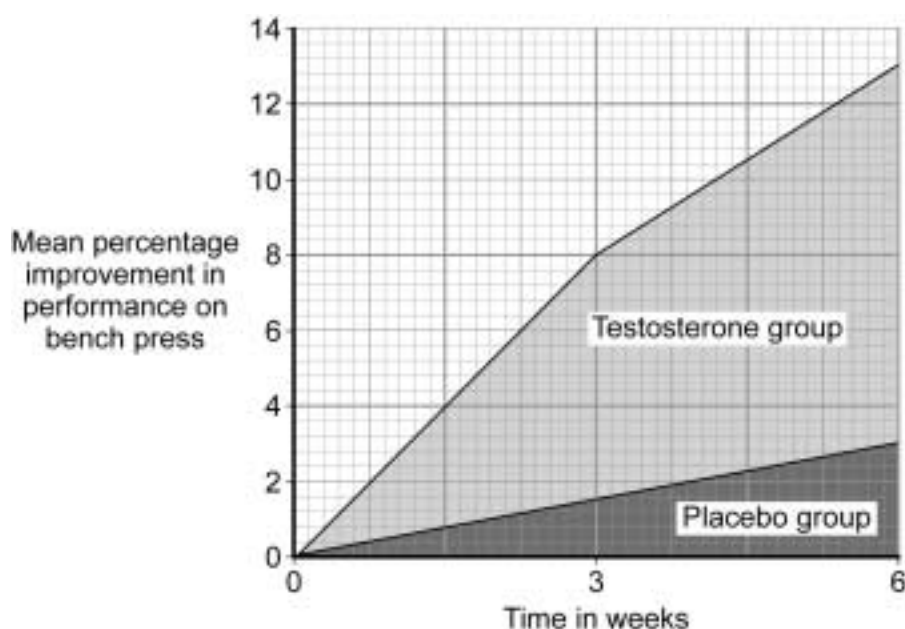
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- 2 Some athletes use drugs containing the steroid testosterone to improve their performance.

In an investigation:

- scientists monitored the performance of 18 male athletes over a 6 week training programme
- 9 athletes were given weekly injections of testosterone with the dose of 3.5 milligrams per kilogram of body mass, for 6 weeks
- the other 9 athletes were given a placebo
- the athletes' performance on a bench press exercise was measured at 3 weeks and 6 weeks.

The graph shows the results of the investigation.



- 2 (a) The data would have been better presented as a bar chart.

Give a reason why.

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(1 mark)

2 (b) Suggest what was given as a placebo in this investigation.

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(1 mark)

2 (c) Describe the results of the investigation.

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(2 marks)

2 (d) Most internet advertisements for testosterone state that athletes need to use testosterone for at least 10 weeks to significantly improve performance.

Do the results of this investigation support the statement in the advertisements?

Give **one** reason for your answer.

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(1 mark)

5

Turn over for the next question

Turn over ►

3 Hormones regulate the functions of many organs.

Complete the following sentences.

3 (a) Hormones control the monthly release of an egg from

the woman's

(1 mark)

3 (b) Hormones also control the thickness of the lining of her

(1 mark)

3 (c) Hormones given to women to stimulate the release of eggs

are called..... drugs.

(1 mark)

3 (d) How are hormones transported around the body?

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(1 mark)

Chemistry Questions

4 Atoms are made up of three main particles.

4 (a) Complete the table to show the names and charges of the particles in an atom.

Name of particle	Charge
proton	
	0
electron	-1

(2 marks)

Use the periodic table on the Data Sheet to help you answer these questions.

4 (b) Why are lithium and sodium in the Group 1 of the periodic table?

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(1 mark)

4 (c) Helium is in Group 0 of the periodic table.

4 (c) (i) Give **one** property of helium that is the same as other gases in Group 0.

.....

(1 mark)

4 (c) (ii) Give **one** property of helium that is different from other gases in Group 0.

.....

(1 mark)

5

Turn over for the next question

Turn over ►

5 Copper is found in the Earth's crust as an ore containing copper sulfide. Large areas of land, where this ore was once quarried, are contaminated with low percentages of copper sulfide. Copper would be too expensive to extract from this contaminated land using the traditional method of quarrying and then heating in a furnace.

5 (a) Extracting copper from this land by the traditional method would have a major environmental impact.

Give **two** reasons why.

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(2 marks)

5 (b) One way to extract the copper from land that contains low percentages of copper sulfide is by bioleaching. Bioleaching uses bacteria. The bacteria produce a solution of copper sulfate.

It is possible to get copper from a solution of copper sulfate using scrap iron.

5 (b) (i) It is economical to use scrap iron to get copper.

Give **one** reason why.

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(1 mark)

5 (b) (ii) Iron can be used to get copper from copper sulfate solution.

Explain why.

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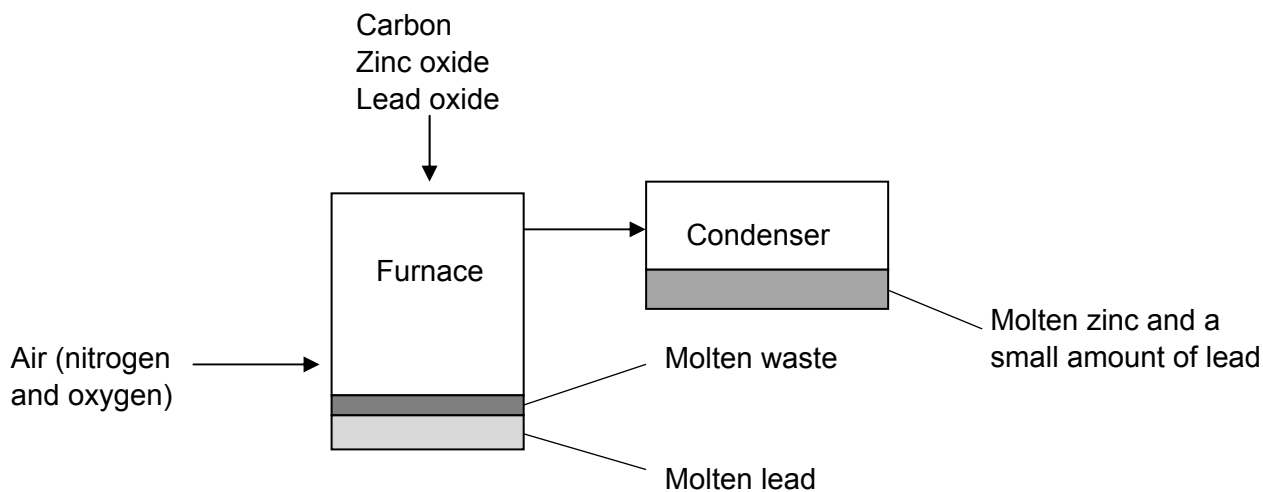
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(2 marks)

- 6** Nearly all zinc is obtained from ores that also contain lead. The metals zinc and lead can be extracted by reducing their oxides using carbon.



- 6 (a)** Complete the following sentence.
Zinc oxide is reduced by carbon, which takes away.....
to leave zinc metal. (1 mark)
- 6 (b)** The melting points and boiling points of lead and zinc are given in the table.

Metal	Lead	Zinc
Melting point in °C	328	420
Boiling point in °C	1740	907
Density in g per cm ³	11.34	7.14

The furnace operates at a temperature of 1200 °C.

- 6 (b) (i)** Explain why only lead metal remains in the furnace.

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(2 marks)

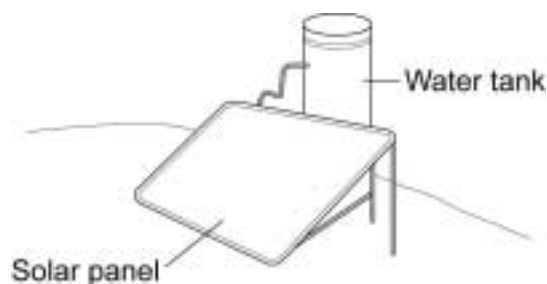
- 6 (b) (ii)** Suggest how zinc can be separated from the lead in the condenser.

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(2 marks)

Physics Questions

- 7 The picture shows one type of solar water heater. Water from the tank is slowly pumped through copper pipes inside the solar panel where the water is heated by energy from the Sun.



- 7 (a) Each day the average European family uses 100 kg of hot water. To kill bacteria, the water going into the tank at 20 °C must be heated to 60 °C.

Calculate the energy needed to increase the temperature of 100 kg of water by 40 °C.

Specific heat capacity of water = 4200 J/kg °C.

Write down the equation you use, and then show clearly how you work out your answer.

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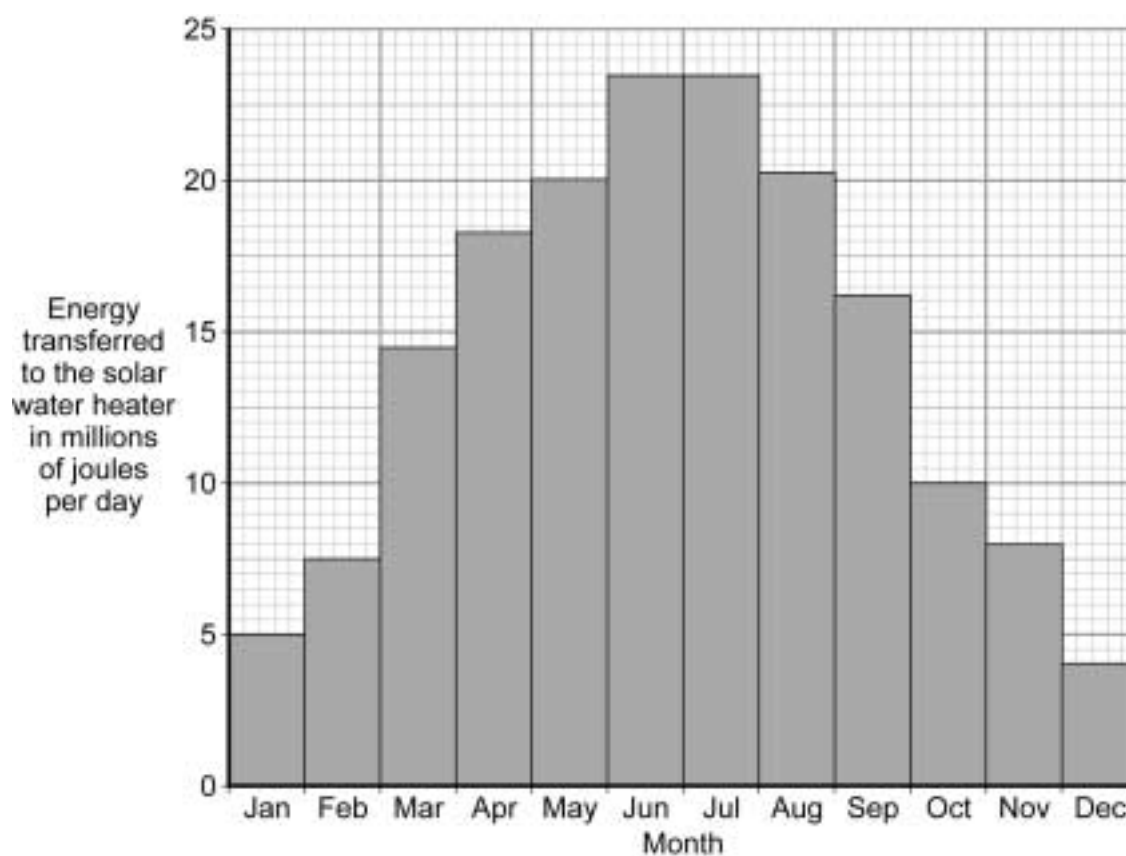
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Energy transferred = J
(2 marks)

- 7 (b) The bar chart shows how the amount of solar energy transferred to the water heater varies throughout the year.



How many months each year will there **not** be enough solar energy to provide the hot water used by an average European family?

..... months
(1 mark)

Question 7 continues on the next page

Turn over ►

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

The water in the tank could be heated by using an electric immersion heater.

Outline the advantages and disadvantages of using solar energy to heat the water rather than using an electric immersion heater.

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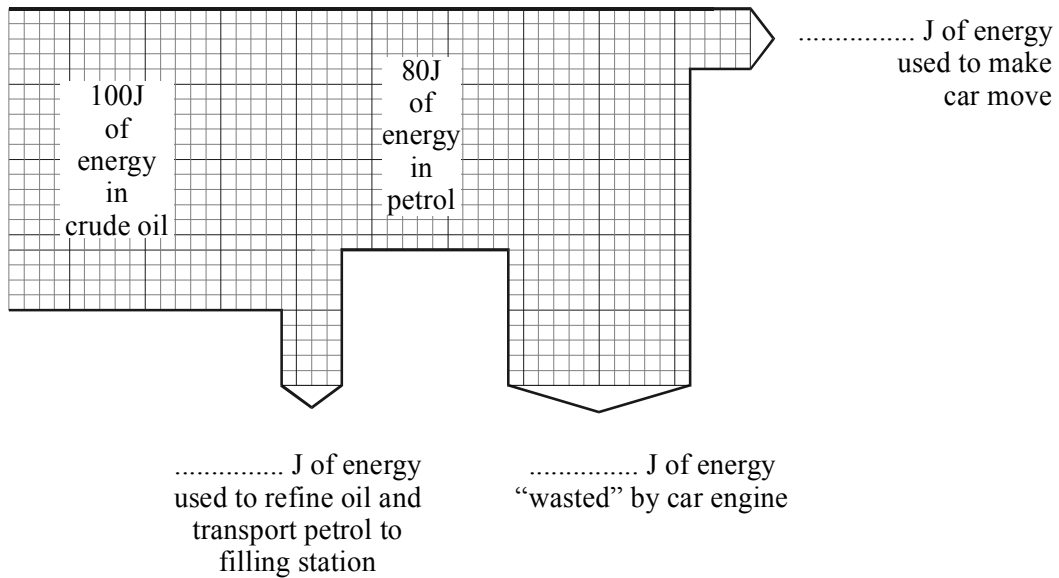
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(6 marks)

- 8** The diagram shows what happens to each 100 joules of energy from crude oil when it is used as petrol in a car.

The widths of the arrows show exactly how much energy is transferred in each particular way.



- 8 (a)** Complete the diagram by adding the correct energy value alongside each arrow.
(2 marks)
- 8 (b)** Calculate how efficient the car engine is at transferring the energy **from petrol** into useful movement.

Show clearly how you work out your answer.

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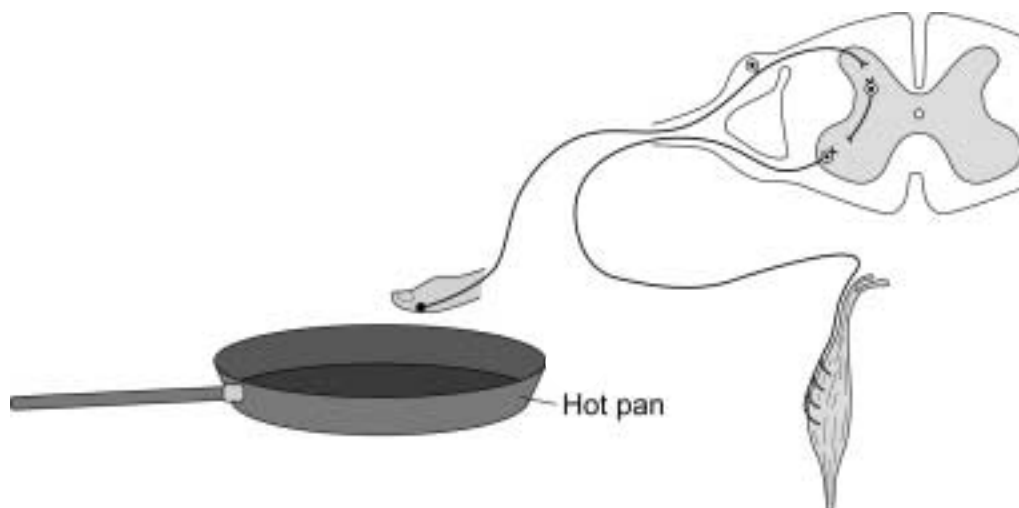
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(2 marks)

Biology Questions

- 9 A person accidentally touches a hot pan.
Her hand automatically moves away from the pan.
The diagram shows the structures involved in this action.



- 9 (a) Describe fully how the structures shown in the diagram bring about this reflex action.

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(6 marks)

- 9 (b) (i)** The nerve pathway in this reflex action is about 1.5 metres in length. A nerve impulse travels at 75 m s^{-1} .

Use this information to calculate the time taken for this reflex action to occur.

Show clearly how you work out your answer.

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Time interval.....s

(2 marks)

- 9 (b) (ii)** The actual time interval is longer than the interval you have calculated in part (i).

Suggest an explanation for the difference.

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(1 mark)

Turn over for the next question

10

Read the information about the trialling of the first contraceptive pill.

The pill was developed by a team of scientists led by Gregory Pincus. The team needed to carry out large scale trials on humans.

In the summer of 1955, Pincus visited the island of Puerto Rico. Puerto Rico is one of the most densely populated areas in the world. Officials supported birth control as a form of population control. The women in Puerto Rico were mainly poor and uneducated.

The scientists selected a pill with a high dose of hormones. The pill was found to be 100 % effective when taken properly. But 17 % of the women in the study complained of side effects.

The women in the trial had been told only that they were taking a drug that prevented pregnancy. They had not been told that the pill was experimental or that there was a chance of dangerous side effects.

Evaluate the issues involved with methods used by Pincus in trialling the contraceptive pill.

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(6 marks)

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Chemistry questions

11 A cement works changes the fuel it uses.

Local residents are concerned because more children are suffering asthma attacks.

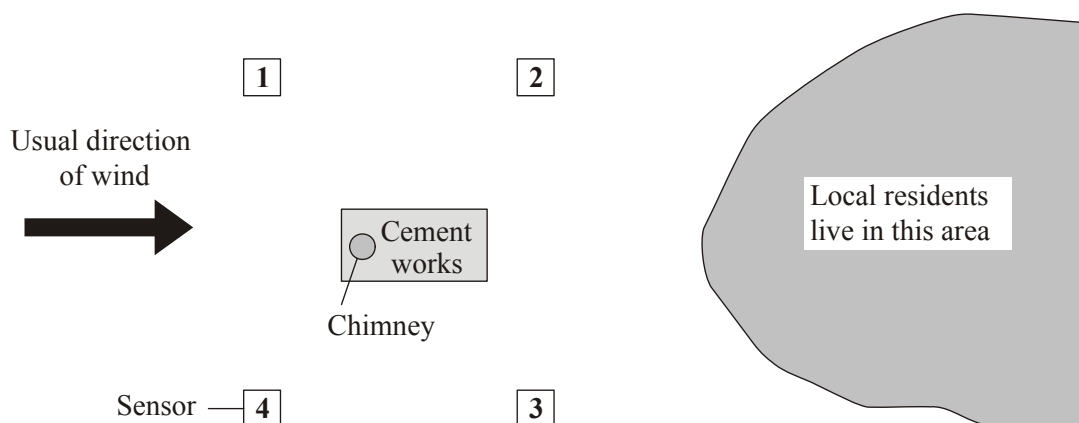
Residents have also noticed that parked cars are becoming dirty because of smoke particles from the chimney.

The table shows the possible medical risk from smoke particles.

Particle size in mm	Medical effect
Larger than 0.4	No medical risks known
0.3 and smaller	Causes asthma attacks
0.2 and smaller	May cause cancer

It is also recommended that to avoid damage to health, the concentration of any particles should be no higher than 2 parts per million (ppm).

Scientists were brought in to monitor the emissions from the cement work's chimney. They positioned four sensors around the cement works to monitor airborne smoke particles.



These four sensors only detect particle sizes larger than 0.5 mm and measure the concentration of particles in ppm. The scientists reported that the particle sensors showed that the average concentration of particles was 1.8 ppm. The scientists concluded that there was no risk to health.

11 (a) Suggest why the local residents objected to the positions of the four sensors.

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(2 marks)

11 (b) What evidence did the scientists use to conclude that there was no risk to health?

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(1 mark)

11 (c) The local residents were still concerned that there was a risk to health, even though the average concentration of particles was 1.8 ppm.

Suggest why they may still be concerned.

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(3 marks)

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Turn over for the next question

Turn over ►

- 12** Crude oil is a mixture of alkanes from which useful fuel fractions can be obtained.

Fraction	A hydrocarbon in this fraction	Boiling point of alkane in °C
petroleum gases	Propane	– 42
petrol (gasoline)	Octane	+126
paraffin (kerosene)	Dodecane	+216
diesel	Eicosane	+344

- 12 (a) (i)** Suggest the lowest temperature to which crude oil needs to be heated to vaporise all of these fuel fractions.

Temperature°C
(1 mark)

- 12 (a) (ii)** Dodecane boils at +216°C. At what temperature will dodecane gas condense to liquid?

Temperature°C
(1 mark)

- 12 (a) (iii)** Describe what happens in a fractionating column that allows these fractions to be collected.

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(3 marks)

12 (b) Propane is a fuel because it burns in air releasing heat energy.

12 (b) (i) Complete the balancing of the two chemical equations for propane burning in air.



(2 marks)

12 (b) (ii) The products of the two chemical reactions in (b)(i) are different.

Explain why.

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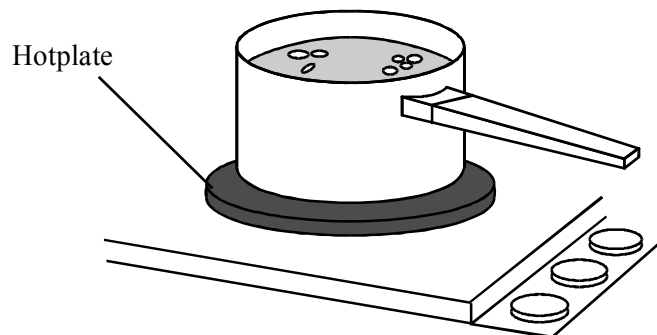
(2 marks)

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Turn over ►

Physics Questions

- 13 (a)** The drawing shows water being heated in a metal saucepan.



- 13 (a) (i)** Some energy is transferred from the hotplate to the air by *infrared radiation*.

What is meant by *infrared radiation*?

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(1 mark)

- 13 (a) (ii)** Explain, in terms of the particles in the metal, how energy is transferred through the base of the saucepan.

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(2 marks)

13 (b) Energy is transferred through the water by convection currents.

Explain what happens to cause a convection current in the water.

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(4 marks)

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Turn over for the next question

Turn over ►

- 14 (a)** The diagram shows a tray of marbles being shaken from side to side. As this happens some of the marbles jump out of the tray.



Explain how the tray of marbles is acting as a model for the evaporation of a liquid.

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(2 marks)

- 14 (b)** Before giving an injection, a nurse dabs some alcohol onto the patient's arm. This makes the patient's skin feel cold.

Explain what happens to make the patient's skin feel cold.

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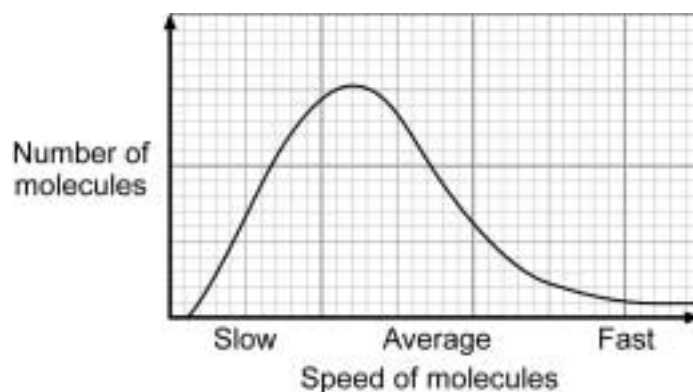
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(2 marks)

- 14 (c)** The graph shows that the molecules in a liquid do not all have the same speed.



Use the information in the graph to explain why a liquid cools down when it evaporates.

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(5 marks)

END OF QUESTIONS

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GCSE Physics Equations Sheet

Unit 5 F and H

$E = m \times c \times \theta$	<p>E energy transferred</p> <p>m mass</p> <p>θ temperature change</p> <p>c specific heat capacity</p>
$\text{efficiency} = \frac{\text{useful energy out}}{\text{total energy in}} (\times 100\%)$	
$\text{efficiency} = \frac{\text{useful power out}}{\text{total power in}} (\times 100\%)$	
$E = P \times t$	<p>E energy transferred</p> <p>P power</p> <p>t time</p>
$v = f \times \lambda$	<p>v speed</p> <p>f frequency</p> <p>λ wavelength</p>