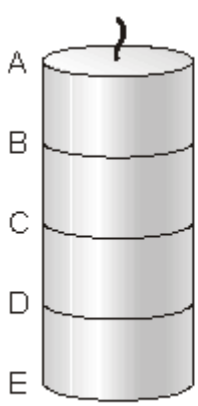
KS3 Science

Combustion

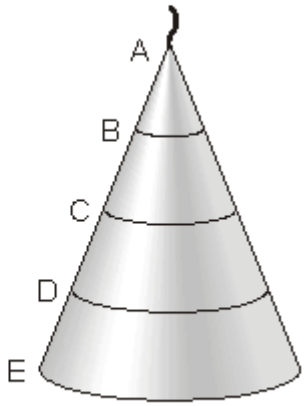
Question Paper

Time available: 30 minutes
Marks available: 44 marks

1. Simon made two candles from the same amount of wax.
He drew lines on both candles.



candle 1



candle 2

(a) What would Simon use to measure the **distance** between the lines?

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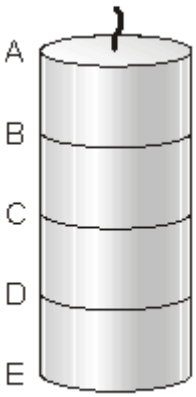
1 mark

(b) He timed how long **candle 1** took to burn.
His results are shown below.



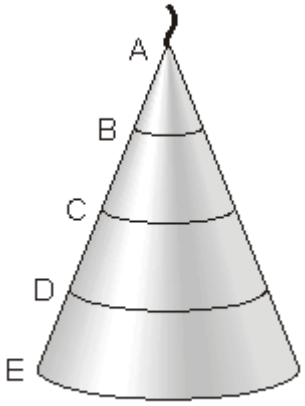
candle 1

(i) How long would it take for **candle 1** to burn from C to D?
Write your answer in the table.

part that burned	time for candle 1 to burn (minutes)
A to B	30
B to C	30
C to D	
D to E	30

1 mark

(ii) Simon timed how long **candle 2** took to burn.



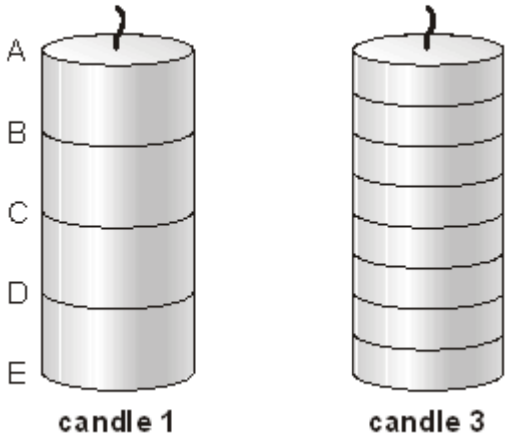
candle 2

How long would it take for **candle 2** to burn from A to B **and** from D to E?
Write your answers in the table.

part that burned	**time for candle 2 to burn (minutes)**
A to B	
B to C	20
C to D	40
D to E	

2 marks

(c) Simon wanted to use a candle to measure time.
He made **candle 3** the same size as **candle 1**.



Why is **candle 3** more useful than **candle 1** for measuring time?

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.....

1 mark
maximum 5 marks

2. The table below gives information about three fuels that can be used in cars.

✓ shows a substance is produced when the fuel burns.
X shows a substance is **not** produced when the fuel burns.

fuel	physical state	energy released, in kJ/kg	some of the substances produced when the fuel burns		
			carbon monoxide	sulphur dioxide	water
petrol	liquid	48 000	✓	✓	✓
hydrogen	gas	121 000	**X**	**X**	✓
ethanol (alcohol)	liquid	30 000	✓	**X**	✓

(a) Which fuel, in the table, releases the **least** energy per kilogram (kg)?

.....

1 mark

(b) Some scientists say that if hydrogen is burned as a fuel there will be less pollution.
From the information in the table, give **one** reason why there will be less pollution.

.....

.....

1 mark

(c) Which of the three **fuels** in the table can be compressed into a small container?

.....

1 mark

(d) Which gas in the air is needed for fuels to burn?
Tick the correct box.

carbon dioxide	☐
nitrogen	☐
oxygen	☐
water vapour	☐

1 mark

(e) Petrol and ethanol are both fuels. Petrol is made from oil.
Scientists say that oil could run out in 100 years.
In some countries people plant sugar cane and use it to make ethanol.

Sugar cane will **not** run out. Explain why.

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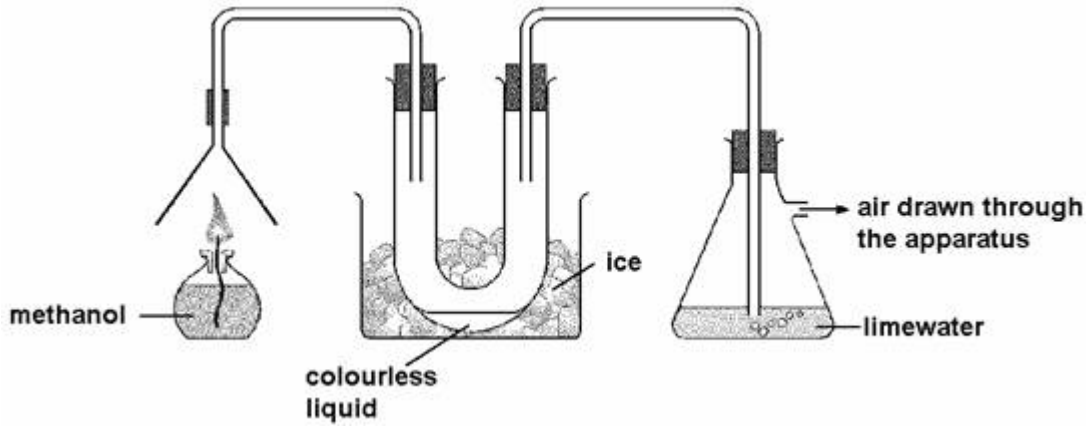
1 mark
Maximum 5 marks

3. (a) George used the apparatus below to find out what substances are produced when methanol burns.



As the methanol burned, two different gases were produced.

(i) One of these gases condensed in the U-tube to give a colourless liquid. Give the name of this liquid.

.....

1 mark

(ii) The other gas turned the lime water cloudy.
Give the name of this gas.

.....

1 mark

(b) Methanol is sometimes used in antifreeze. It can be added to water in car windscreen wash-bottles to prevent the water from freezing in cold conditions.

(i) The label on the bottle of antifreeze has two hazard warning symbols. What **two** precautions would you need to take when using this antifreeze?

1. .....

.....

2. .....

.....

1 mark

(ii) Water freezes at 0°C. The label on the bottle shows how the freezing point changes when different amounts of antifreeze are added to water.

Terry put a mixture containing 10% antifreeze into the wash-bottle of his car. During the night the temperature dropped to –14°C.
The wash-bottle burst.
Explain why the wash-bottle burst.

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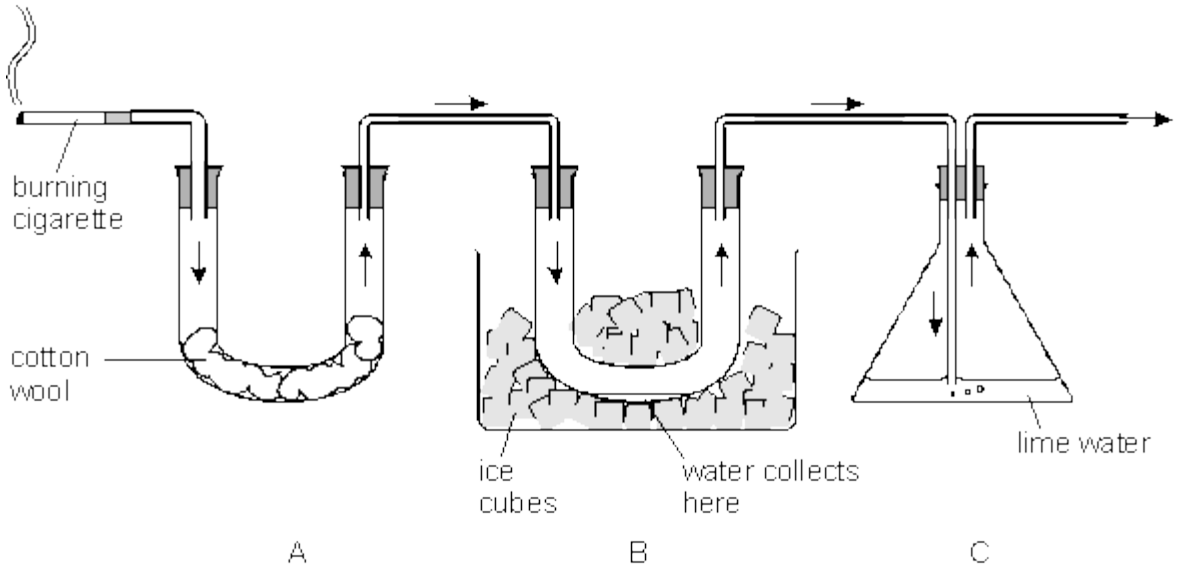
2 marks
Maximum 5 marks

4. A teacher set up the following apparatus to separate the chemicals in cigarette smoke.
The chemicals pass through the apparatus in the direction of the arrows.



(a) In A, a brown sticky substance collected on the cotton wool. This substance causes lung cancer. Give the name of the brown substance.

.....

1 mark

(b) As the cigarette burned, water vapour was produced and water collected in B.

(i) Why were ice cubes needed in B?

.....

.....

1 mark

(ii) In the boxes below, draw the arrangement of particles of water vapour and particles of liquid water.

Use a circle, O, to represent each particle.

2 marks

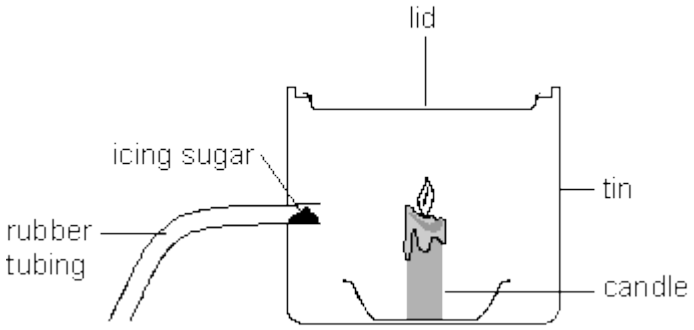
(c) The lime water in C became cloudy. What gas turns lime water cloudy?

.....

1 mark

Maximum 5 marks

5. A teacher set up the following apparatus behind a safety screen.
She placed 1 g of icing sugar in the end of the rubber tubing inside the tin, as shown below.



The teacher blew through the other end of the rubber tubing.
The icing sugar came into contact with the flame.
There was a loud explosion and the lid was blown off the tin.

(a) Complete the following sentence describing the energy changes which took place.

..... energy in the icing sugar changed to

..... energy and ..... energy.

3 marks

(b) As a result of the explosion, the lid of the tin was pushed off.
Explain what had happened to the gas molecules inside the tin to make this happen.

.....

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.....

.....

2 marks

(c) When icing sugar is burned in this experiment, the gas **used** and the gas **produced** are the same as when energy is released from sugar in the cells of the body.

(i) Which gas, in the air, is **used** when the icing sugar burns?

.....

1 mark

(ii) Give the name of the gas **produced** when the icing sugar burns.

.....

1 mark

(d) The table below shows the energy values of four food substances.

food substance	energy value, in kJ per 100 g
icing sugar	1680
curry powder	979
flour	1450
custard powder	630

The teacher repeated the experiment with 1 g of custard powder.
What difference would this make to the experiment?

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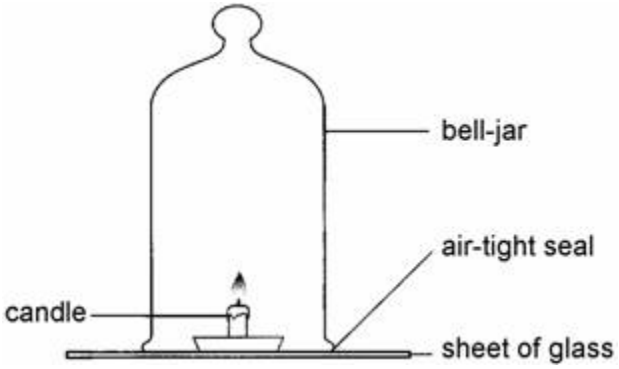
1 mark
Maximum 8 marks

6. The diagram below shows a candle burning in air under a bell-jar.



(a) (i) When the candle burns, there is a reaction. Give the chemical formulae of the products of this reaction.

1. .....

2. .....

2 marks

(ii) As the candle burns, some of the candle wax is used up. Give two other observations which would show that a chemical reaction is taking place.

1. .....

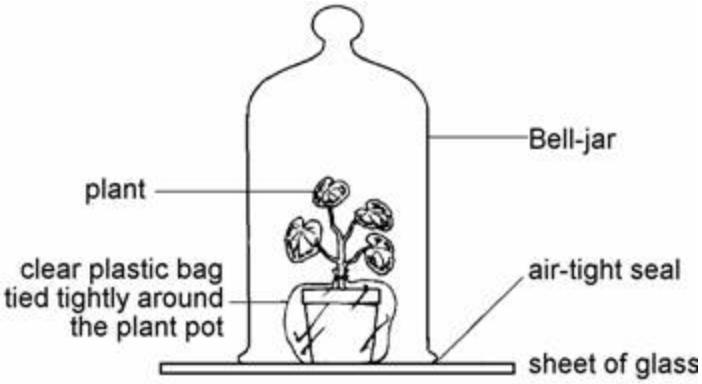
.....

2. .....

.....

2 marks

(b) A potted plant is placed under a bell-jar as shown below.



Photosynthesis in the leaves causes changes in the proportion of the gases in the bell-jar.

(i) In bright sunlight, what are **two** of these changes?

1. .....

2. .....

2 marks

(ii) Explain why the changes will be different if the plant is kept in the dark.

.....

.....

.....

2 marks

(c) Chlorophyll is the green substance present in cells in the leaves.

(i) Give the name of the part of the cell which contains chlorophyll.

.....

1 mark

(ii) Which part of the cell controls the production of chlorophyll?

.....

1 mark

Maximum 10 marks

7. The exhaust gases of a car with a petrol engine are analysed during its 'MOT test'. The results are shown below.

gas	% volume
carbon monoxide	3.0
carbon dioxide	13.0
oxygen	0.4
other gases	83.6

(a) The air going into the engine contains about 20% of oxygen.
Explain why there is only 0.4% of oxygen in the exhaust gases coming out of the car engine.

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1 mark

(b) (i) Petrol is a mixture of compounds which contains only carbon and hydrogen.
Complete combustion of petrol produces carbon dioxide and **one** other substance.
What is this other substance?

.....

1 mark

(ii) When petrol is burned in the car engine, carbon monoxide is produced as well as carbon dioxide.

Explain why carbon monoxide is dangerous and may kill you.

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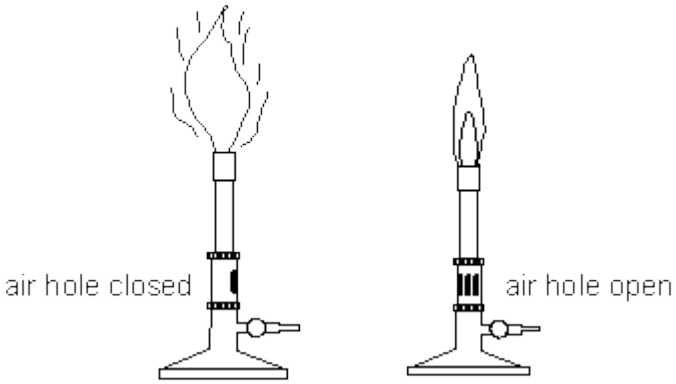
1 mark

Maximum 3 marks

8. The diagrams show two Bunsen burners. One burner has the air hole closed, and the other has the air hole open.



(a) Explain why opening the air hole of a Bunsen burner makes the flame hotter.

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1 mark

(b) Natural gas is methane, CH_4. It is burned in a Bunsen burner.
Complete the word equation for the chemical reaction in the clear blue flame.

methane + ... → ..... + ...

2 marks
Maximum 3 marks