Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4463/01

SCIENCE A/PHYSICS

PHYSICS 1
FOUNDATION TIER

A.M. MONDAY, 16 June 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**4**	
3.	**6**	
4.	**11**	
5.	**10**	
6.	**12**	
7.	**12**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
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.
A list of equations is printed on page 2. In calculations you should show all your working.
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **7***(a)*(i).

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Equations

density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
energy transfer = power × time	$E = Pt$
units used (kWh) = power (kW) × time (h) cost = units used × cost per unit	
% efficiency = $\frac{\text{useful energy [or power] transfer}}{\text{total energy [or power] input}} \times 100$	
wave speed = wavelength × frequency	$c = \lambda f$
speed = $\frac{\text{distance}}{\text{time}}$	

SI multipliers

Prefix	Multiplier	
m	10^{-3}	$\frac{1}{1\,000}$
k	10^{3}	1 000
M	10^{6}	1 000 000

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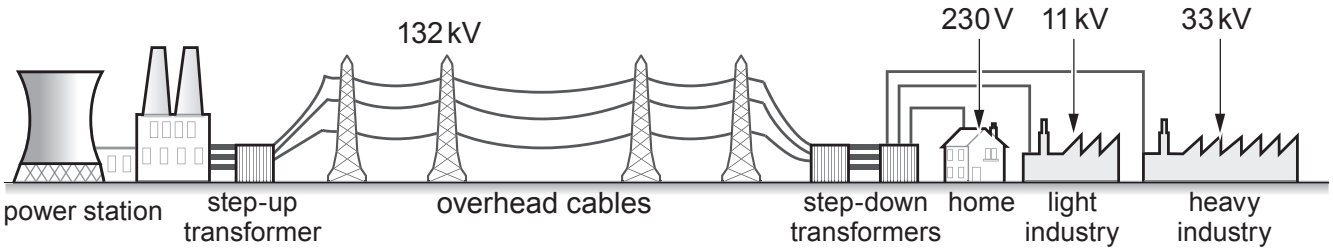
Answer **all** *questions.*

1. The diagram below shows part of the National Grid.



(a) Use the information in the diagram to answer the following questions.

(i) Name the part where the voltages are highest. [1]

.....

(ii) Name the part that makes the voltage safer for users in homes. [1]

.....

(iii) Name the part that reduces current. [1]

.....

(b) State **two** advantages of joining power stations together in the National Grid. [2]

1. .....

2. .....

5

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2. Infra-red, radio waves and microwaves are types of electromagnetic radiation used in long distance communication.

(i) Complete the table below by selecting from **infra-red, radio waves** or **microwaves**. [3]

Method of communication	Type of radiation used
Optical fibre signals	.....
Satellite communication	.....
Signals from mobile phone masts	.....

(ii) Which of the three types of radiation given above has the longest wavelength? [1]

.....

4

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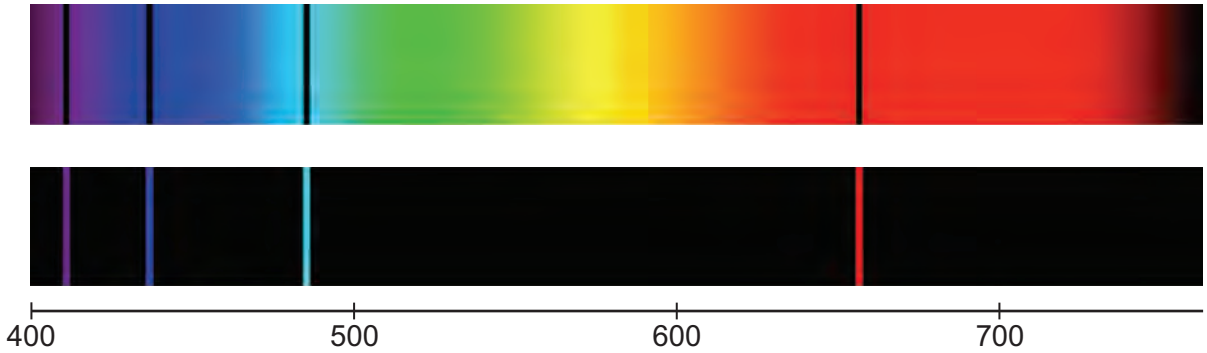
3. *(a)* The diagram below shows two **spectra** produced by hydrogen gas.
The **top** spectrum is produced when **white** light is passed through hydrogen.
The **bottom** spectrum is produced by glowing hydrogen.



(i) State **two** ways in which they are similar. [2]

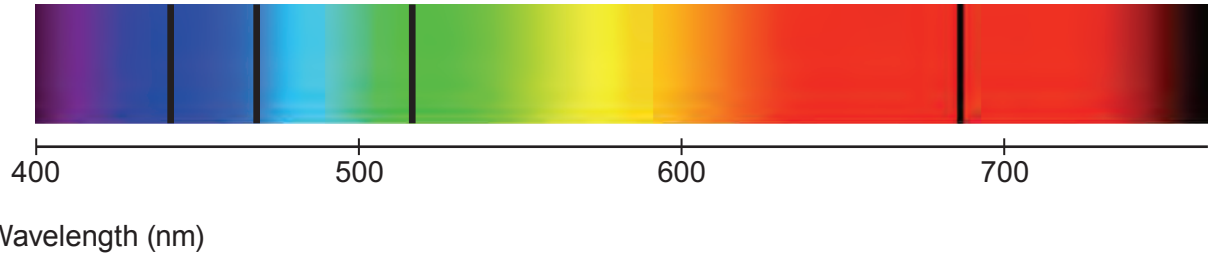
1. .....

2. .....

(ii) State **one** way in which they are different. [1]

.....

(b) The hydrogen spectrum below is from a distant star.



(i) How is it different from the top hydrogen spectrum in *(a)*? [1]

.....

(ii) What does this tell you about the star? [1]

.....

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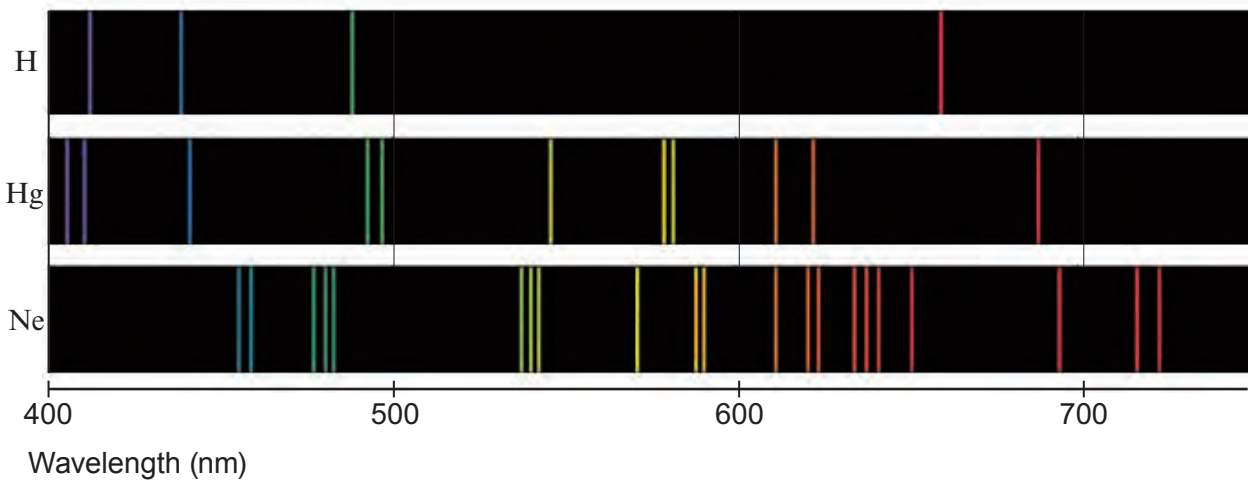
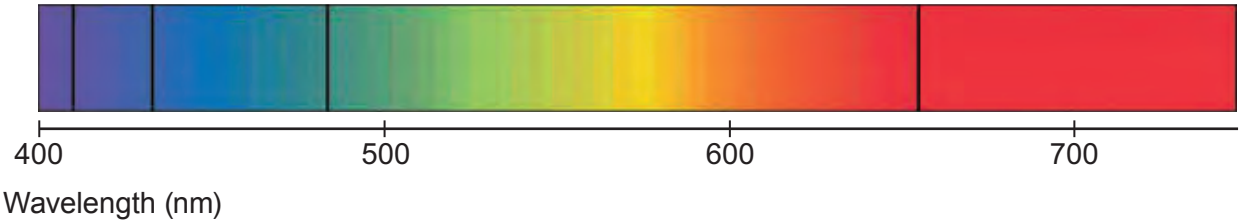
(c) The first three spectra below are the emission spectra of glowing gases of hydrogen (H), mercury (Hg), and neon (Ne). The bottom spectrum is the absorption spectrum from a nearby gas cloud.

Emission spectra



Absorption spectrum from gas cloud



How can you tell the gas cloud does not contain any neon or mercury vapour? [1]

.....

.....

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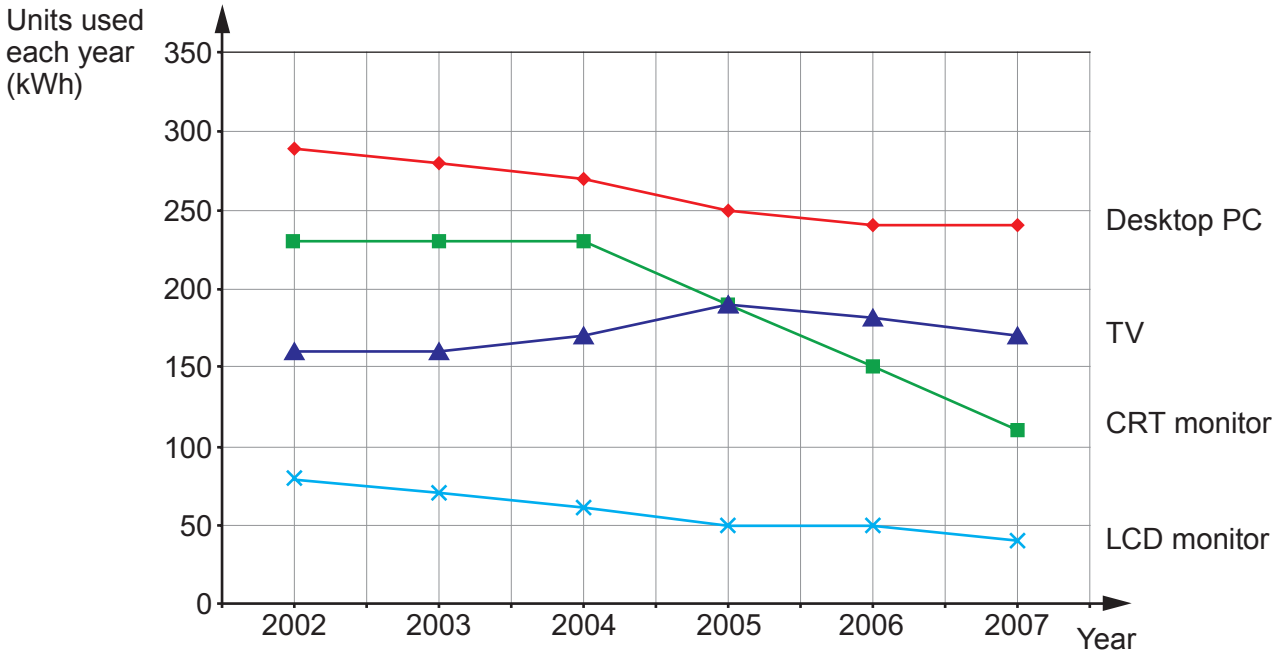
4. *(a)* The graph shows the number of units of electricity (kWh) used each year by four different electrical items bought new in each of the years 2002 to 2007.



Use information from the graph above to answer the following questions.

(i) State which item uses the most energy every year. ..... [1]

(ii) In which year do the CRT monitor and TV use the same number of units? [1]

.....

(iii) In 2005 which item costs 5 times as much to run as the LCD monitor? [1]

.....

(iv) Explain which item has the greatest improvement in its efficiency between 2002 and 2007. [2]

.....

.....

.....

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(b) Use the information in the table to answer the questions that follow.

Type of monitor	CRT monitor	LCD monitor
Electrical power input (W)	90	30
Useful power output (W)	18	20

(i) Use an equation from page 2 to calculate the efficiency of the CRT monitor. [2]

efficiency = ... %

(ii) How many joules of energy does the CRT monitor waste each second? [1]

..... J

(iii) The CRT monitor has a power of 90 W and costs £4.50 to run.

(I) Calculate the cost of using the LCD monitor for the same amount of time. [2]

cost = £ .....

(II) How much would be saved by using the LCD monitor instead of the CRT monitor for this time? [1]

saving = £ .....

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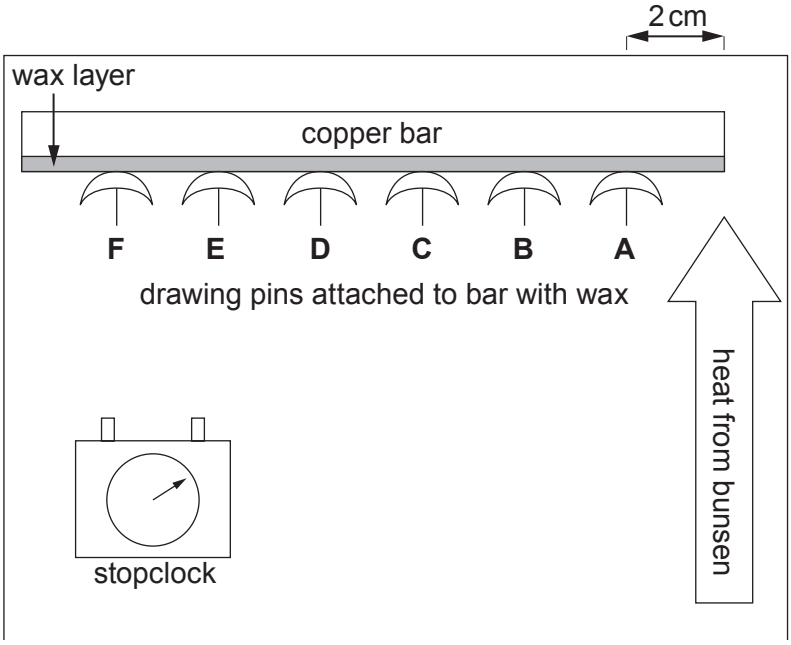
5. An experiment to investigate heat transfer along a copper bar is set up as shown in the diagram.



Wax melts at 70°C

Diameter of copper bar = 1 cm

Length of copper bar = 14 cm

Mass of each drawing pin = 1 g

Distance between each pin = 2 cm

Bunsen burner blue flame used.

The stopclock reads to the nearest second.

A Bunsen burner heats the copper bar at one end.
The time that each drawing pin drops off the bar is recorded and a graph is plotted.

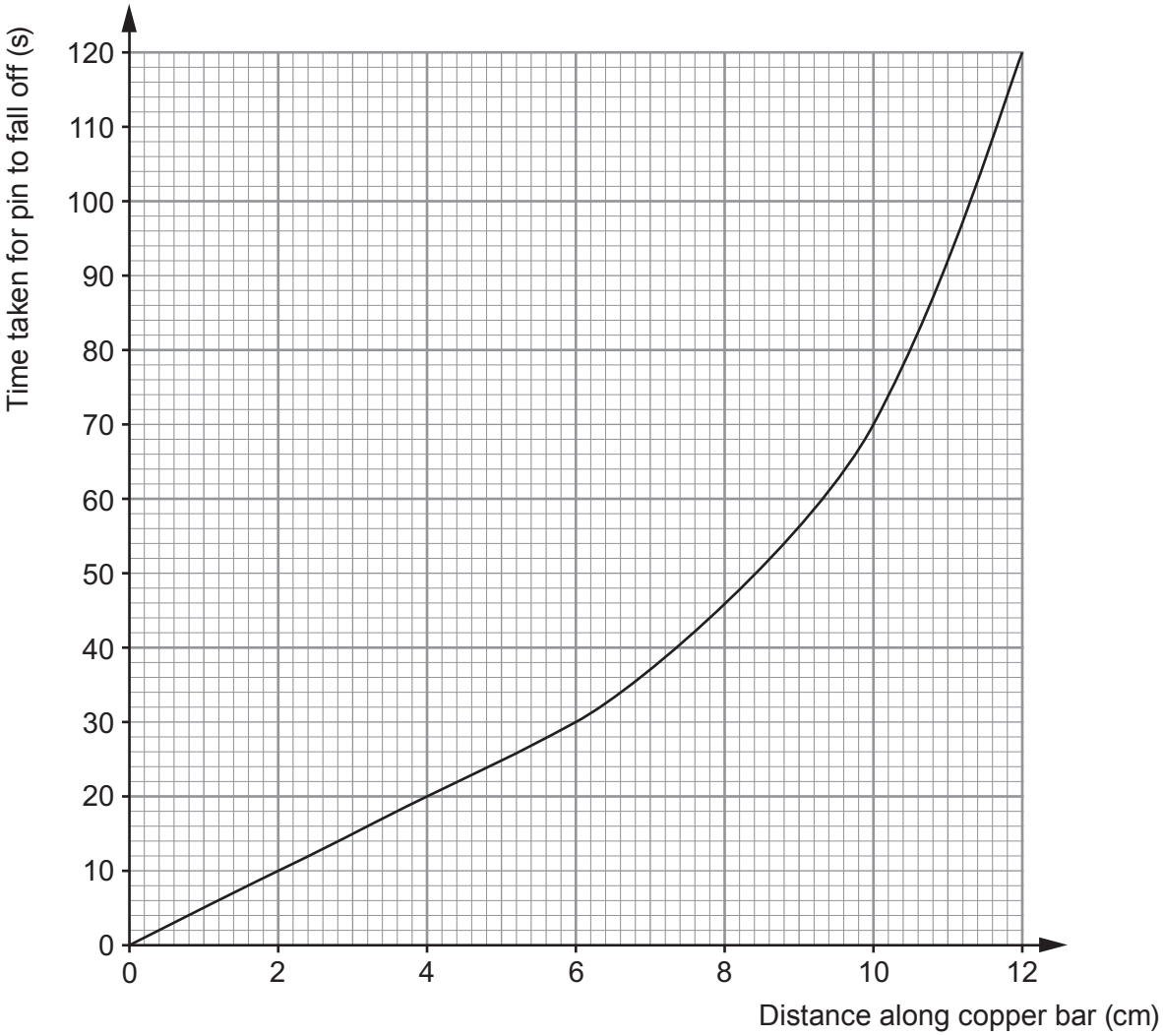
(a) Use some of the following words to complete the sentences below.
Each word may be used **once**, **more than once** or **not at all**.

conduction	convection	radiation	hot	cold

The heat energy passes along the copper bar by ..... causing the wax to melt. The bar gives out energy in all directions by ..... . Energy moves from the ..... end to the ..... end of the bar. [3]

Examiner only

(b) The graph is shown below.



(i) Use the graph to complete the table of results. Some results have already been completed. [2]

Distance along copper bar (cm)	0	2	4	6	8	10	12
Time taken for pin to fall off (s)	0	10	20	30	.....	.....	120

(ii) How long did it take drawing pin **C** to fall from the copper bar? ..... s [1]

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(c) (i) The experiment is repeated with a steel bar. State **two** ways of making the experiment fair. [2]

1. .....

2. .....

(ii) Use the information below to explain why the results would be different if this steel bar was used instead. [2]

Rate of conduction along copper bar = 212 units

Rate of conduction along steel bar = 26 units

.....

.....

.....

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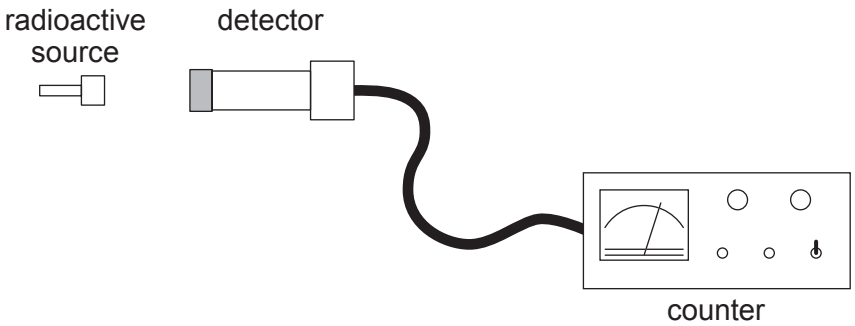
Examiner only

6. Many radioactive sources emit more than one kind of radiation. The apparatus below can be used to identify the radiations that a source gives out. Different absorbers are placed in turn between the source and detector and the reading on the counter is taken.



An experiment produced the following results. **All figures have been corrected for background radiation**.

Absorber placed between detector and source	Count rate (counts per minute)
No absorber	5 000
Thin card	5 000
3 mm thickness of aluminium	4 000
10 mm thickness of lead	500

(a) (i) Name **one** radiation that is **not** given out by this source. [1]

.....

(ii) How much of the original radiation is absorbed by the aluminium? [1]

..... counts per minute

(iii) How much of the original count rate was produced by beta radiation? [1]

..... counts per minute

Examiner only

(b) When gamma radiation passes through lead from a different source, the counts per minute depend on the thickness of lead between the source and the counter in the way shown in the table.

Thickness of lead between source and detector (mm)	Count rate (counts per minute)
0	8 000
10	4 000
30	1 000
40	500
50	250

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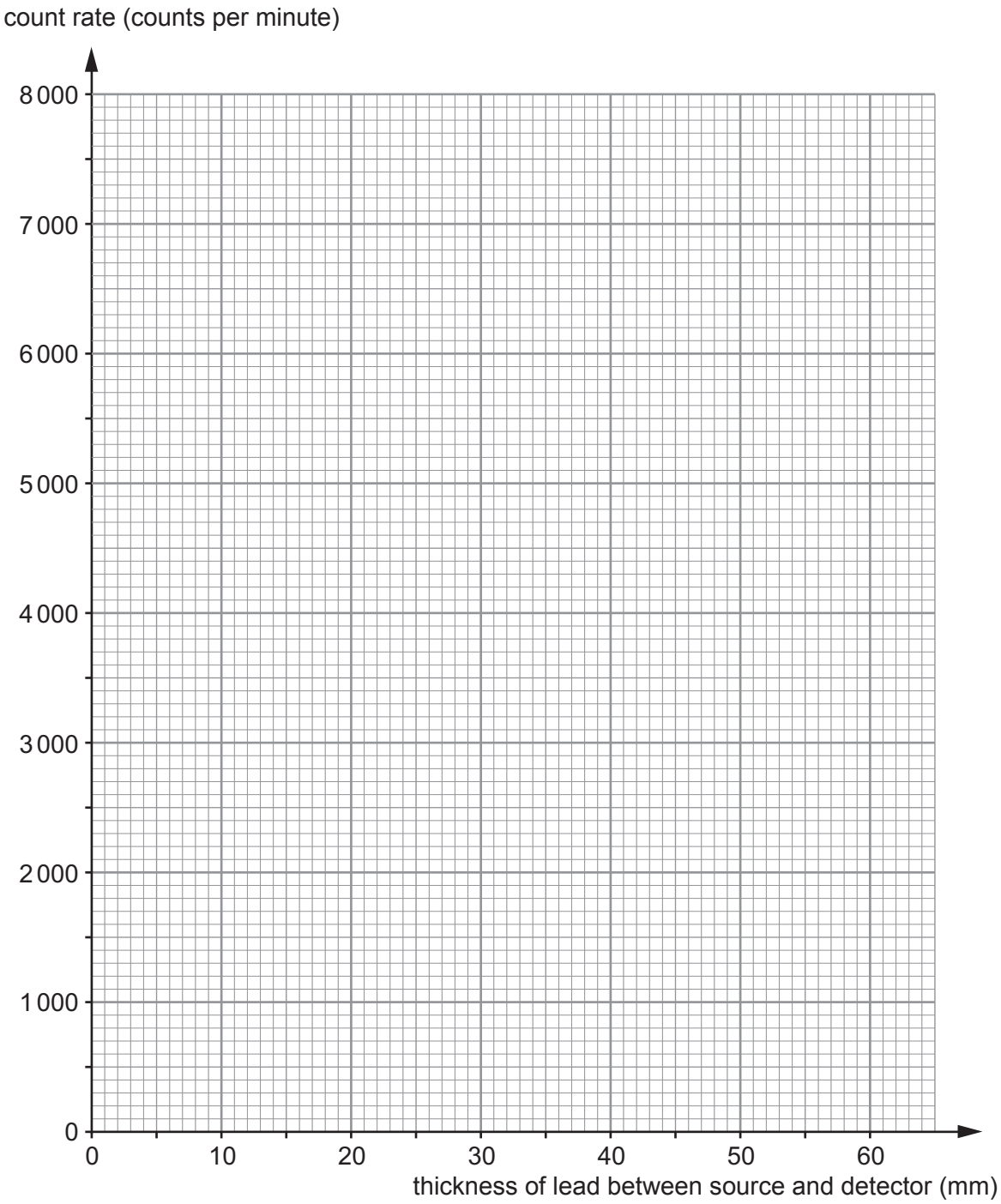
(i) Plot the data on the grid below and draw a suitable line. [3]



(ii) Use the graph to describe the relationship between the count rate and the thickness of lead. [2]

.....

.....

.....

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(iii) The count rate for a 10 mm thickness of lead is 4 000 counts per minute.

(I) What **fraction** of this would be detected for a 30 mm thickness of lead? [2]

fraction = ...

(II) What count rate would be detected for a 60 mm thickness of lead? [1]

count rate = ... counts per minute

State how you arrived at your answer. [1]

.....

.....

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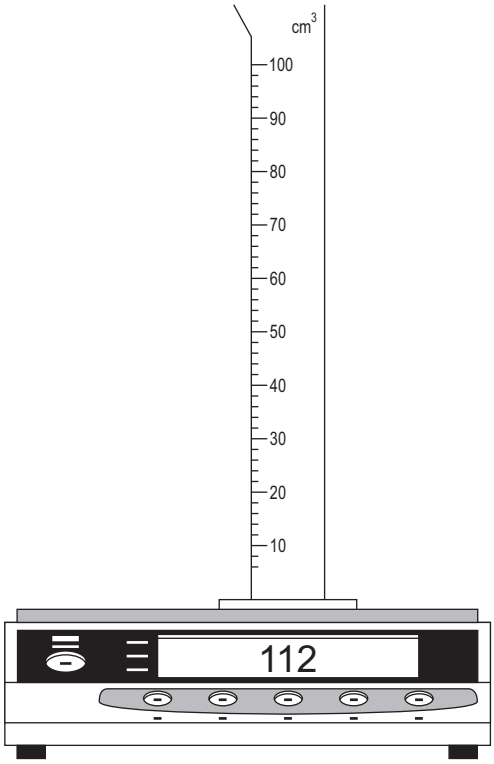
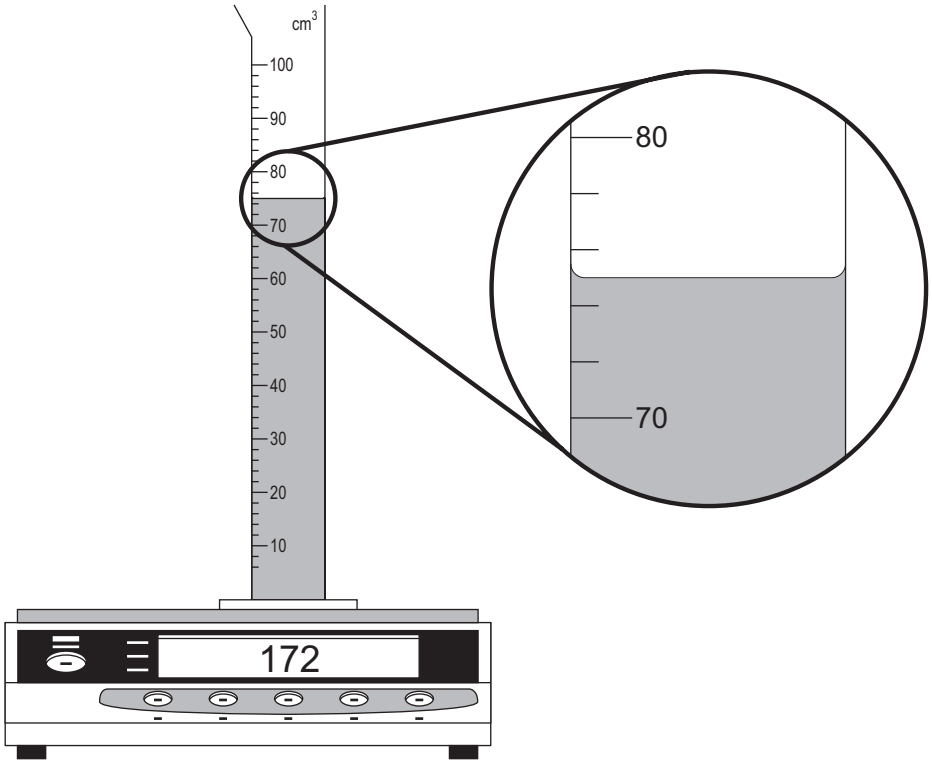
7. *(a)* A pupil wants to find the density of an oil. She uses a chemical balance which measures to the nearest gram (g). She places an empty measuring cylinder on to the balance.



She pours some oil into the cylinder. The level of oil in the measuring cylinder is shown.



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(i) Use this data to find the density of oil.

- Use an equation from page 2.
- Show all your workings.
- Explain each stage in your calculation. [6 QWC]

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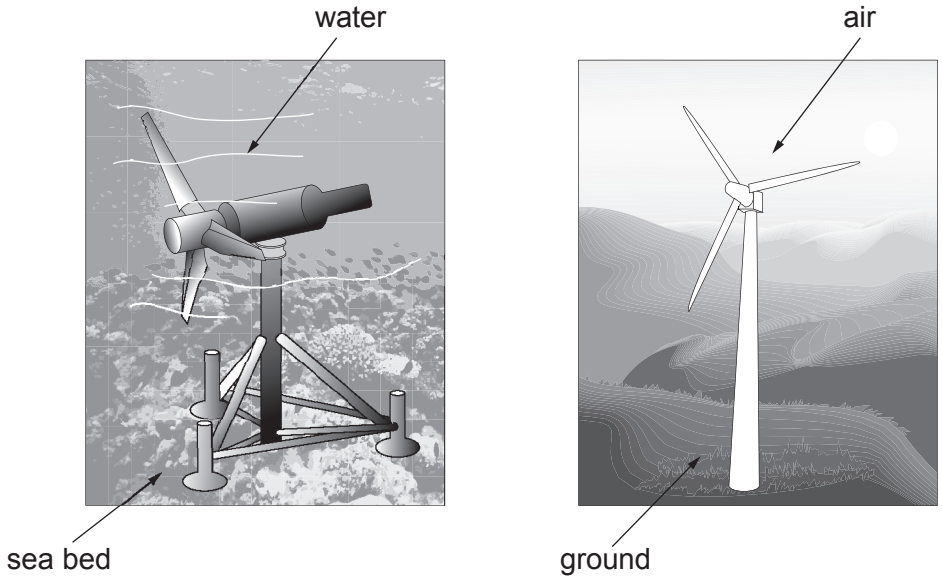
(ii) State **two** ways in which the density of the oil could be found to a greater accuracy. [2]

1. .....

2. .....

(b)



tidal water turbine wind turbine

The table below shows differences between tidal water turbines and wind turbines.

	Tidal water turbine	Wind turbine
Speed of water or wind (m/s)	5	15
Density of water or air (kg/m^3)	1 000	1
Length of blade (m)	10	35
Area swept out by blade (m^2)	314	3 850
Power output at this speed (MW)	2.9	1.5

Examiner only

(i) Use information from the table opposite to answer the following questions.

(I) Calculate the difference in power output between the two types of turbine.[1]

power = ...

unit = ...

(II) State **one** reason why water turbines have a bigger power output than wind turbines. [1]

.....

.....

(ii) Other than having a larger power output, explain **one** advantage that tidal water turbines have over wind turbines. [2]

.....

.....

.....

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END OF PAPER

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