Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3430U30-1

S18-3430U30-1

SCIENCE (Double Award)

Unit 3 – PHYSICS 1
FOUNDATION TIER

FRIDAY, 15 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**6**	
3.	**12**	
4.	**11**	
5.	**12**	
6.	**15**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen. Do not use correction fluid.

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. If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

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

The assessment of the quality of extended response (QER) will take place in question ***3(a)***.

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Equations

current = $\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
total resistance in a series circuit	$R = R_1 + R_2$
energy transferred = power × time	$E = Pt$
power = voltage × current	$P = VI$
% efficiency = $\frac{\text{energy [or power] usefully transferred}}{\text{total energy [or power] supplied}} \times 100$	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
units used (kWh) = power (kW) × time (h) cost = units used × cost per unit	
wave speed = wavelength × frequency	$v = \lambda f$
speed = $\frac{\text{distance}}{\text{time}}$	

SI multipliers

Prefix	Multiplier
m	1×10^{-3}
k	1×10^{3}
M	1×10^{6}

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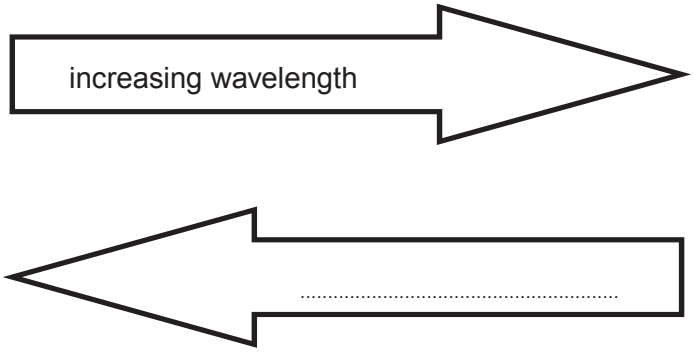
Answer **all** *questions.*

1. Various types of radiation form a continuous spectrum called the electromagnetic (em) spectrum. The diagram shows the regions of the em spectrum.

Gamma rays	X-rays	Ultraviolet	Visible light	**A**	Microwaves	Radio waves



(a) (i) Complete the arrow above, using **only one** of the following phrases. [1]

- **decreasing speed**
- **increasing speed**
- **increasing frequency**
- **decreasing energy**

(ii) Name the em radiation labelled **A** in the diagram. [1]

.....

(b) (i) Name the ionising em wave given out by some radioactive materials. [1]

.....

(ii) State why ionising em radiation is dangerous to humans. [1]

.....

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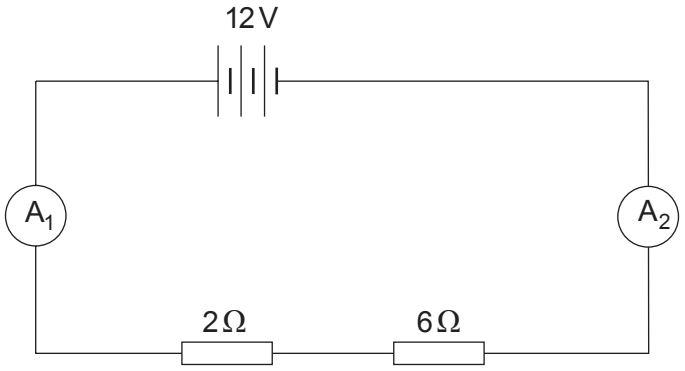
2. In class, a group of students set up a simple series circuit as shown in the diagram below.



(a) (i) Use the equation:

$$R = R_1 + R_2$$

to calculate the total resistance in the circuit. [1]

Total resistance = ... Ω

(ii) Use an equation from page 2 to calculate the current reading on ammeter A_1. [2]

Ammeter A_1 reading = ... A

(iii) State the current reading on ammeter A_2. [1]

Ammeter A_2 reading = ... A

(b) The 6 Ω resistor is now removed from the circuit. It is added **in parallel** with the 2 Ω resistor. The circuit is complete.

Complete the following sentences by underlining the correct phrase or word. [2]

(i) The total resistance of the circuit (**increases** / **stays the same** / **decreases**).

(ii) The current reading on the ammeter A_1 (**increases** / **stays the same** / **decreases**).

6

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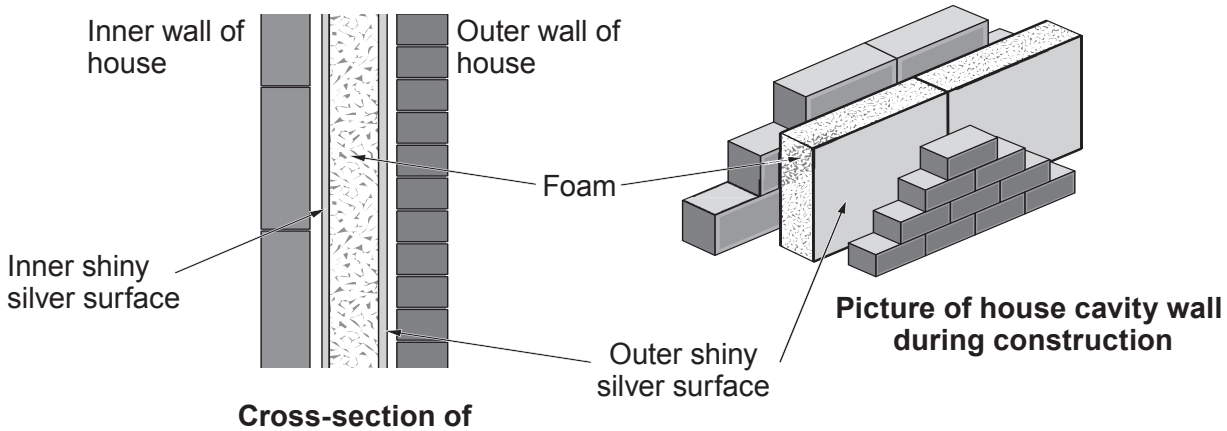
3. About 30 % of all the heat lost from an uninsulated house escapes through the walls.

Houses built in Wales since 1990 have wall insulation installed. One type of insulation that is commonly used is cavity board. This is a sheet of solid foam that is covered on both sides with shiny silver foil. During construction, sheets of cavity board are placed between the inner and outer walls of the house.



Cross-section of house cavity wall

Picture of house cavity wall during construction

(a) Explain why heat is lost through the walls of a house **and** how cavity board can reduce this heat loss by **conduction**, **convection and radiation**. [6 QER]

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(b) The table shows some information about three types of house with cavity board installed. All three houses use gas central heating.

Type of house	Cost of installing cavity board (£)	Saving per year (£)	Carbon footprint without cavity board installed (kg of CO_2 / year)	CO_2 saving with cavity board installed (kg / year)	Carbon footprint with cavity board installed (kg of CO_2 / year)
detached	720	275	5500	1100	4400
semi-detached	480	160	3640	.....	3000
mid-terraced	385	110	2440	440	.....

(i) The payback time of installing cavity board in a semi-detached house is 3 years. A semi-detached house owner claims that she has a longer payback time than the owner of the **mid-terraced** house. Explain whether you agree with her statement. *Space for workings.* [2]

.....

.....

(ii) **Complete the table** for the two missing values. *Space for workings.* [2]

(iii) Use information in the table to explain which of the three types of house has the **smallest** impact on the environment. [2]

.....

.....

.....

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Turn over.

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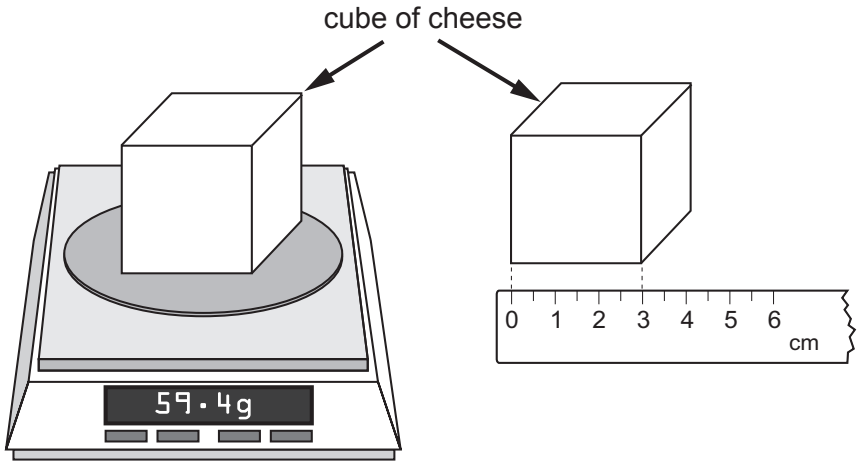
4. A North Wales cheese producer checks the quality of their cheese by measuring its density. This can be carried out experimentally. The two diagrams show measurements that were carried out on a cube of cheese. The balance read 0.0 g before the cube of cheese was placed on it.



(a) (i) Write down the mass of the cheese cube. ..... g [1]

(ii) Write down the length of one side of the cheese cube. ..... cm [1]

(iii) Use the equation:

volume of a cuboid = length × width × height

to calculate the volume of the cheese cube in cm^3. [1]

Volume = ... cm^3

(iv) Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

to calculate the density of the cheese cube and state the unit. [3]

Density = ... Unit = ...

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(b) (i) A worker at the cheese factory suggests that the mass of the cheese cube should be measured more than once. State **two** reasons why this is good scientific practice. [2]

.....

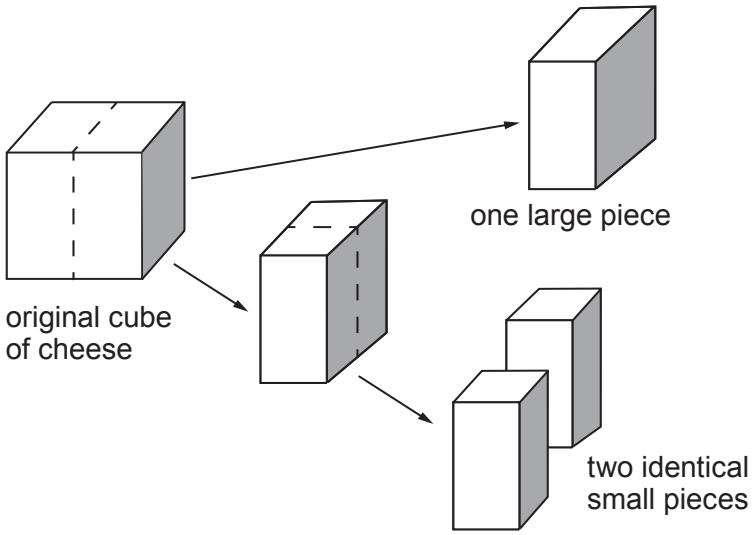
.....

(ii) State how the **measurements** could be improved. [1]

.....

.....

(c) The cube of cheese used in the experiment is now cut into two identical halves. One of these pieces is then cut in half. The sample of cheese has been divided into three pieces, one large piece and two identical small pieces.



Tick (✓) the **two** correct statements. [2]

One of the small pieces of cheese is $\frac{1}{3}$ of the mass of the large piece. ☐

One of the small pieces of cheese is $\frac{1}{3}$ of the volume of the large piece. ☐

The three pieces of cheese have the same density. ☐

The mass of the large piece of cheese is half the mass of the original cube. ☐

The mass to volume ratio for each of the three samples is different. ☐

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5. The diagram shows an electric hand drier connected to a 230 V a.c. mains supply.

(a) Complete the following sentence by underlining the correct phrase. [1]

An a.c. or alternating current (**continuously changes direction / continuously changes frequency / continuously changes speed**).

(b) The electric hand drier has a label attached to it.

Electric hand drier
Power = 2600 W 230 V a.c

(i) Each time the hand drier is used it blows out hot air for 15 seconds. Use an equation from page 2 to calculate the energy transferred by the hand drier if it is used **6 times**. [3]

Energy transferred = ... J

(ii) Use the equation:

$$\text{current} = \frac{\text{power}}{\text{voltage}}$$

to calculate the current when the hand drier is used. [2]

Current = ... A

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(iii) The hand drier is connected to the mains with a standard three-core cable. Complete the table below with the value of the current in each wire in the connecting cable when the hand drier is operating normally. [2]

Wire	Current (A)
live	.....
neutral	.....
earth	.....

(c) A fault develops and the live wire touches the metal case of the hand drier. Explain how a residual current circuit breaker (rccb) protects the user. [2]

.....

.....

.....

(d) A salesperson for a replacement hand drier claims it will use fewer units of electricity each time it is used because its power is 1300 W. When it operates it blows hot air for double the time. Explain if you agree with the claim of the salesperson. [2]

.....

.....

.....

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6. Water waves on the sea where the water is shallower than $\frac{1}{20}$ of their wavelength are known as shallow water waves. The speed of shallow water waves is described by the equation:

$$v = 3.13\sqrt{d}$$

where v is the wave speed (in m/s) and d is the depth of the water (in m).
This equation applies to sea waves whose wavelengths range between 10 m and 150 m.

In regions of the sea where the depth is small, for example near the shore, the speed noticeably changes but the frequency of the waves remains constant.

A shallow water wave is an example of a transverse wave.

(a) Describe what is meant by a transverse wave. [2]

.....

.....

(b) (i) Use the equation above to **complete the table below**. [2]
Space for workings.

Depth of water, d (m)	$\sqrt{d}$	Wave speed, v (m/s)
0	0	0
0.5	0.71	2.21
1.0	1.00	3.13
1.5	.....	3.83
2.5	1.58	4.95
3.0	1.73	5.42
3.5	1.87	.....
4.0	2.00	6.26

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(ii) Chris suggests that if the depth of the water increases four times, the wave speed doubles. **Use data in the table opposite** to explain whether or not this statement is true. [2]

.....

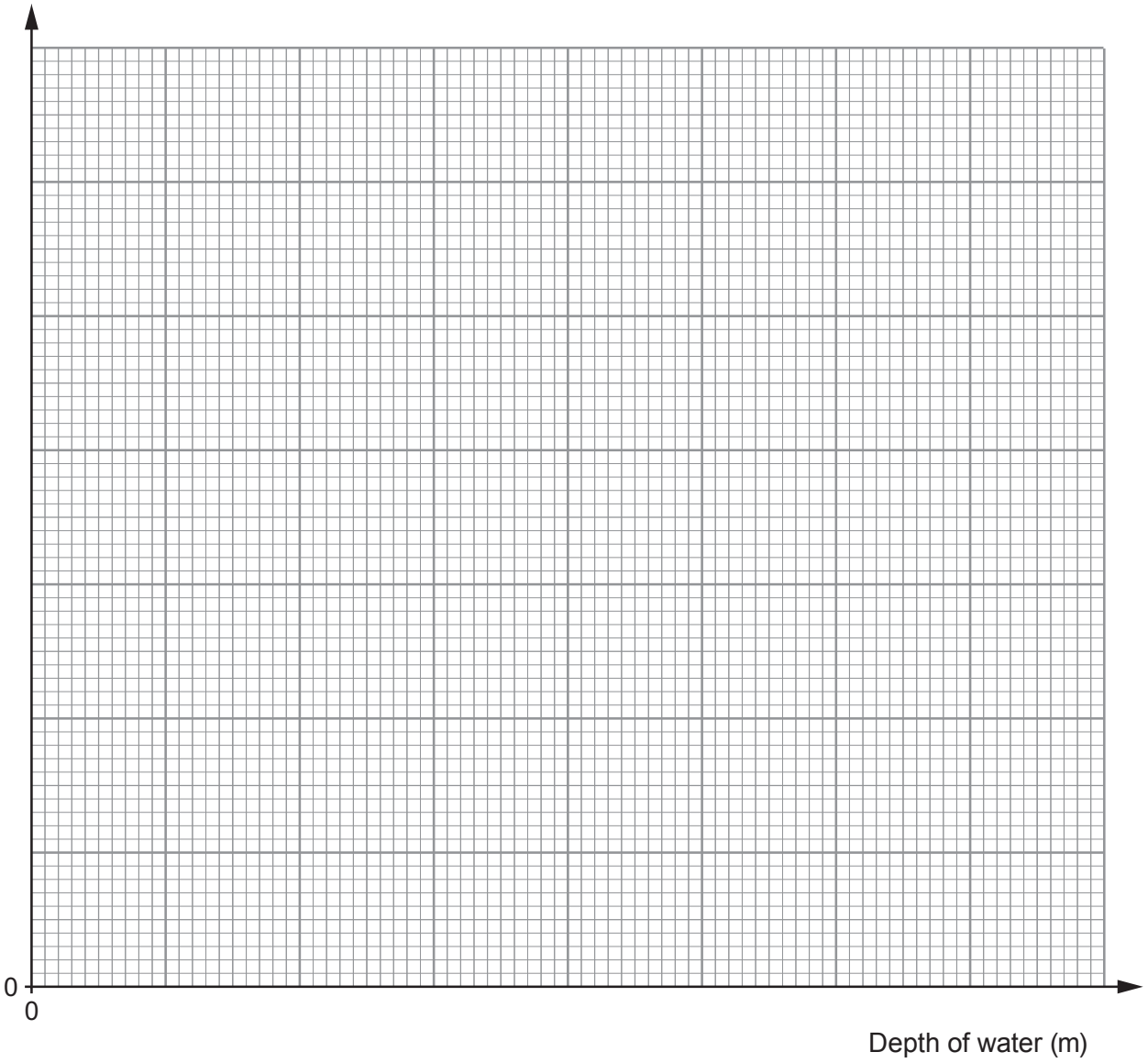
.....

.....

.....

(iii) Plot the data on the grid below and draw a suitable line. [4]

Wave speed (m/s)



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(c) (i) Use the graph and the equation:

$$\text{wavelength} = \frac{\text{wave speed}}{\text{frequency}}$$

to calculate the wavelength of water waves that have a frequency of 0.2 Hz in water that is 2.0 m deep. [3]

Wavelength = ... m

(ii) Chris now suggests that as the depth increases, the wavelength decreases. Explain whether this statement is correct. [2]

.....

.....

.....

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.

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