Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Physics

Unit: 4PH0
Science (Double Award) 4SC0
Paper: 1P

Thursday 12 January 2012 – Morning
Time: 2 hours

Paper Reference
4PH0/1P
4SC0/1P

Materials required for examination.
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P40138A

1/1/1/

P 4 0 1 3 8 A 0 1 3 2

PEARSON

EQUATIONS

You may find the following equations useful.

energy transferred = current × voltage × time	$E = I \times V \times t$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
$\text{frequency} = \dfrac{1}{\text{time period}}$	$f = \dfrac{1}{T}$
$\text{power} = \dfrac{\text{work done}}{\text{time taken}}$	$P = \dfrac{W}{t}$
$\text{power} = \dfrac{\text{energy transferred}}{\text{time taken}}$	$P = \dfrac{W}{t}$
$\text{orbital speed} = \dfrac{2\pi \times \text{orbital radius}}{\text{time period}}$	$v = \dfrac{2 \times \pi \times r}{T}$

Where necessary, assume the acceleration of free fall, $g = 10\ \text{m/s}^2$.

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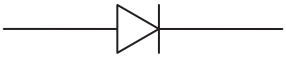
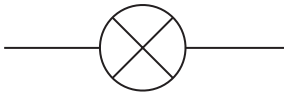
Answer ALL questions.

1 (a) The diagram shows some electrical circuit symbols.

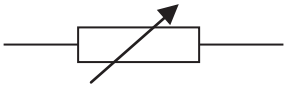
A



B



C



D

(i) Which symbol represents a switch?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) Which symbol represents a diode?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) A hairdryer connected to the mains supply takes a current of 5.5 A.

(i) Which of these fuses should be used with the hairdryer?

(1)

- ☒ **A** 3 A
- ☒ **B** 5 A
- ☒ **C** 7 A
- ☒ **D** 13 A

(ii) Explain your answer.

(1)

(iii) The hairdryer has a plastic case so there is no need for an earth wire connection in the plug.

Explain why the hairdryer is still safe to use.

(2)

(Total for Question 1 = 6 marks)

2 A student measures the density of water.

She uses a measuring cylinder and an electronic balance.

(a) State the equation linking density, mass and volume.

(1)

(b) A correct unit for density is

(1)

- ☒ **A** g/cm
- ☒ **B** kg/cm
- ☒ **C** g/cm^2
- ☒ **D** g/cm^3

(c) Complete the table to show what is measured by an electronic balance.

(1)

Measuring instrument	What it measures
measuring cylinder	volume
electronic balance	

(d) Describe how the student should use each instrument to make her measurements as accurate as possible.

(4)

Measuring cylinder

Electronic balance

(e) The student wants to make sure her experiment is a fair test.

(i) State **one** factor that she should keep the same throughout her experiment.

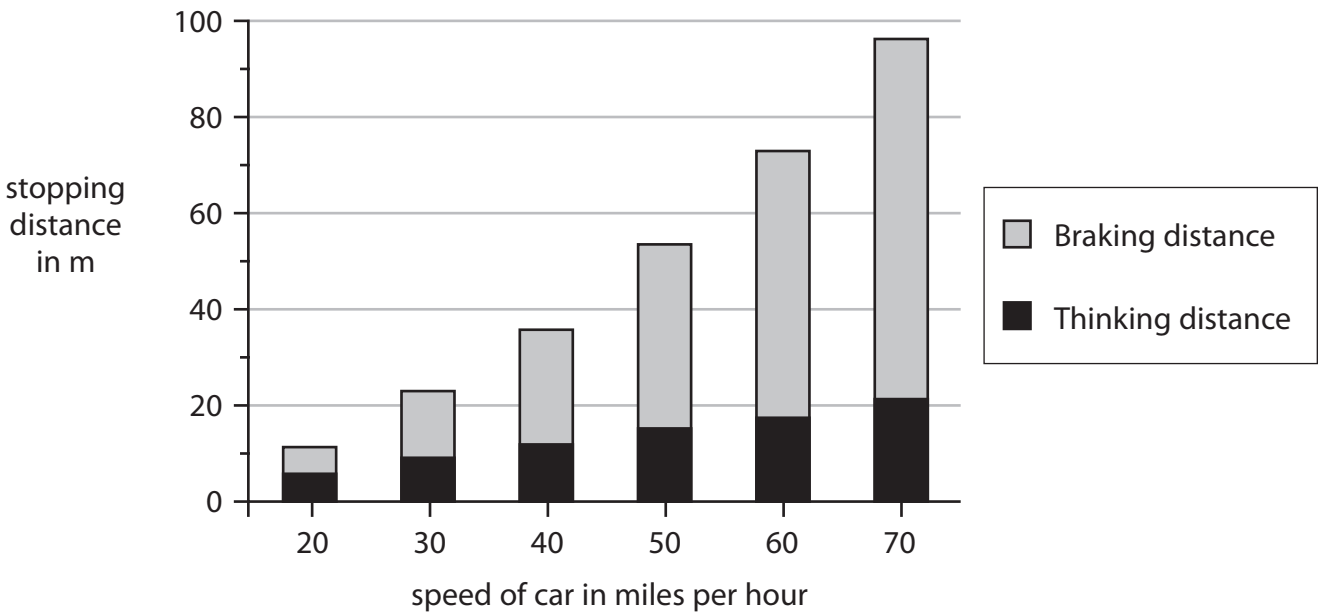
(1)

(ii) Why is it important that she keeps this factor constant?

(1)

(Total for Question 2 = 9 marks)

3 The graph shows the minimum stopping distances, in metres, for a car travelling at different speeds on a dry road.



(a) Complete the equation to show the link between stopping distance, thinking distance and braking distance.

(1)

Stopping distance = ...

(b) Describe the patterns shown in the graph.

(2)

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(c) Use the graph to estimate the stopping distance for a car travelling at 35 miles per hour.

(1)

Stopping distance = ... m

(d) To find the minimum stopping distance, several different cars were tested.

Suggest how the data from the different cars should be used to give the values in the graph.

(1)

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(e) The tests were carried out on a dry road.

If the road is icy, describe and explain what change there would be, if any, to

(i) the thinking distance

(2)

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(ii) the braking distance

(2)

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(Total for Question 3 = 9 marks)

4 A student is investigating refraction of light.

(a) What is **refraction**?

(1)

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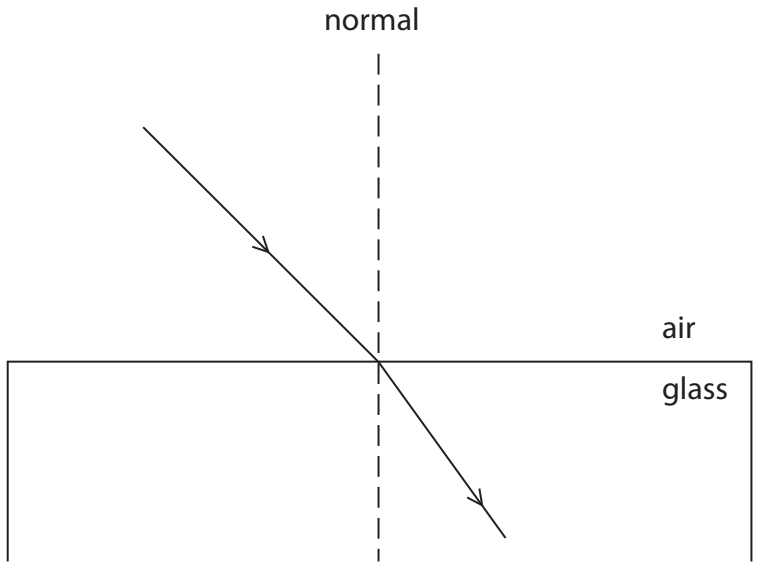
(b) The diagram shows a ray of light travelling from air to glass.

Add labels to show the angle of incidence, *i*, and the angle of refraction, *r*.

(2)

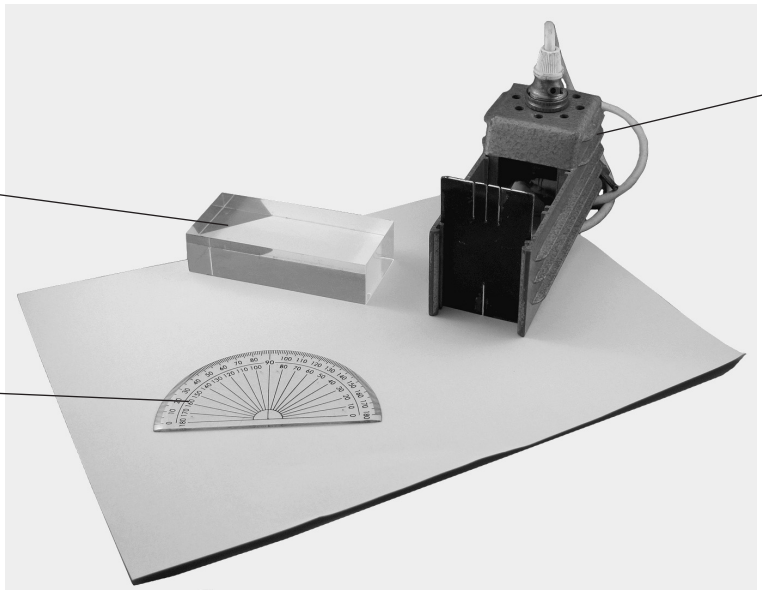


(c) The student wants to find the refractive index of the glass.

(i) State the equation linking refractive index, angle of incidence and angle of refraction.

(1)

(ii) The photograph shows the apparatus the student has available.



Describe how the student should carry out the experiment.

You should include:

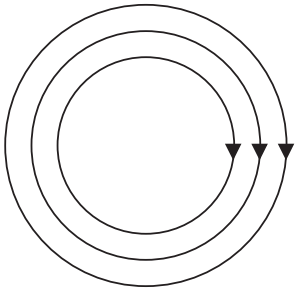
- what the student should measure
- how the measurements should be made
- how the student should use a graph to find the refractive index.

(6)

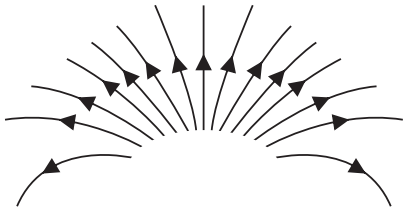
(Total for Question 4 = 10 marks)

5 A magnetic field pattern can be shown using lines.

(a) The diagram shows some magnetic field patterns.



A



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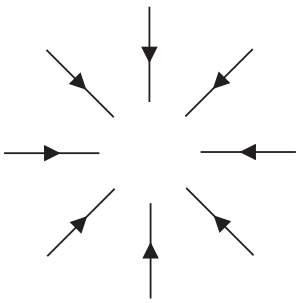

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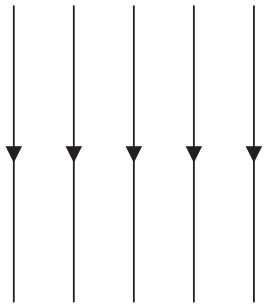

D

Which pattern shows a **uniform** magnetic field? Explain your answer.

(2)

Pattern .....

Explanation .....

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(b) Explain how to produce a uniform magnetic field.

(3)

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(Total for Question 5 = 5 marks)

6 A teacher shows his class how to investigate the half-life of a radioactive source.

(a) The readings from the counter need to be corrected for background radiation.

(i) State **one** source of background radiation.

(1)

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(ii) Describe the method the teacher should use to correct for background radiation.

(3)

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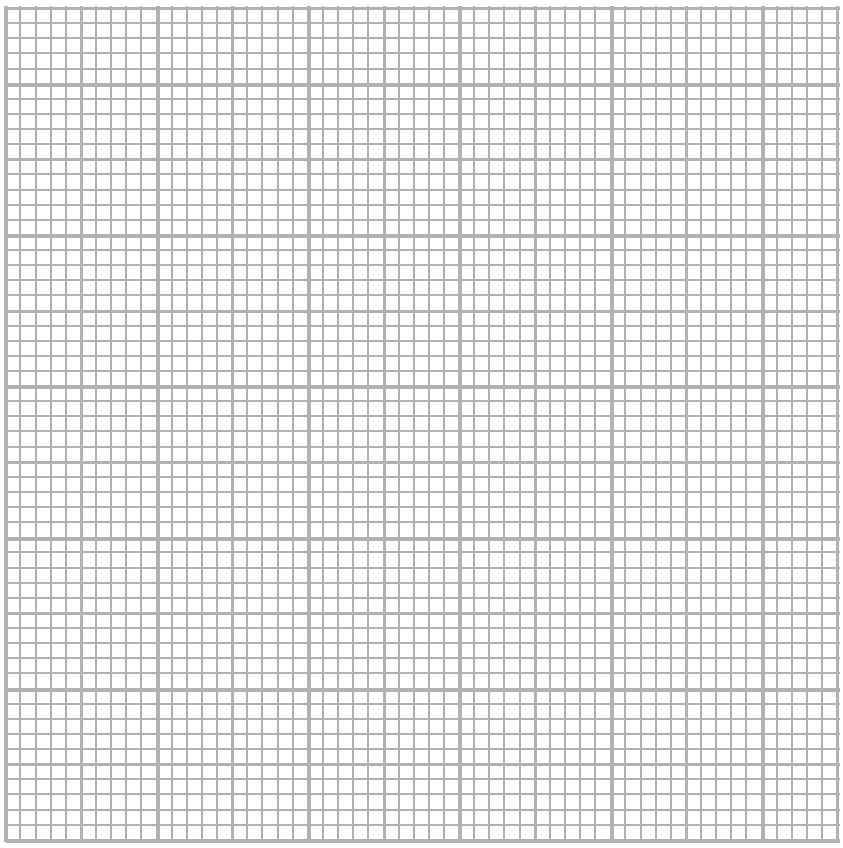
(b) Every half a minute, the teacher records the count rate.

He corrects for background radiation and produces this results table.

Time in minutes	Corrected count rate in Bq
0	49
0.5	30
1.0	24
1.5	18
2.0	15
2.5	11
3.0	10
3.5	9
4.0	5
4.5	6

(i) Draw a graph of corrected count rate against time for these results.

(5)



(ii) Use your graph to estimate the half-life for this material.

(1)

Half-life = ... minutes

(c) The isotope technetium-99 is a gamma emitter with a half-life of 6 hours. It is used as a radioactive tracer in medicine.

The technetium-99 is injected into a patient's bloodstream and carried around the body by the blood. The radiation it emits is detected outside the body.

Explain why technetium-99 is suitable for use as a tracer in this way.

(3)

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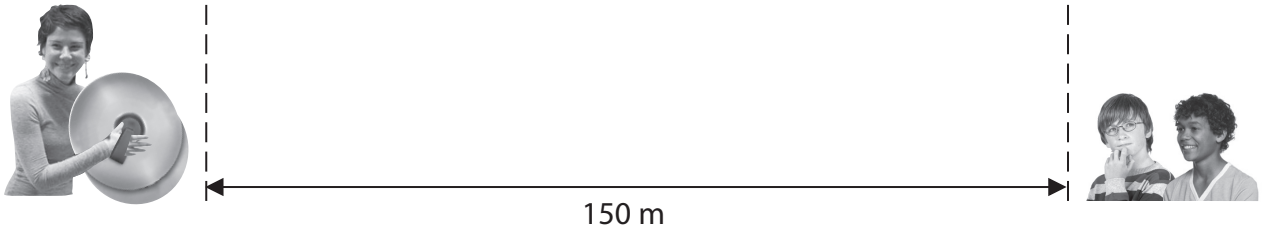
(Total for Question 6 = 13 marks)

7 A teacher and two students are measuring the speed of sound.



The teacher makes a loud sound by hitting two cymbals together.

Each student starts a stopwatch when they see the teacher hit the cymbals. They each stop their stopwatch when they hear the sound.

(a) Describe how a sound wave moves through the air.

(3)

(b) The students repeat the experiment and record their readings in a table.

Student	Time in s
Andrew	0.44, 0.46, 0.44, 0.48, 0.43
Kefe	0.5, 0.6, 0.4, 0.4, 0.6

(i) State the precision of Andrew's readings.

(1)

.....

(ii) State the equation linking speed, distance travelled and time taken.

(1)

(iii) The teacher was standing 150 m from the students.

Use the experimental data recorded by each student to complete the table below.

Give your answers to an appropriate number of significant figures.

(3)

Student	Mean (average) time in s	Speed of sound in m/s
Andrew		
Kefe		

(c) The students look in a data book and find that the speed of sound in air is given as 341 m/s.

The students discuss their results.

My experiment was more accurate because my answer was closest to 341 m/s.

No, you didn't allow for reaction time. My result is the best that you can get with this method.

No, reaction time didn't matter because I had to react twice and it cancelled out.

Andrew

Kefe

Evaluate these conclusions.

(5)

(Total for Question 7 = 13 marks)

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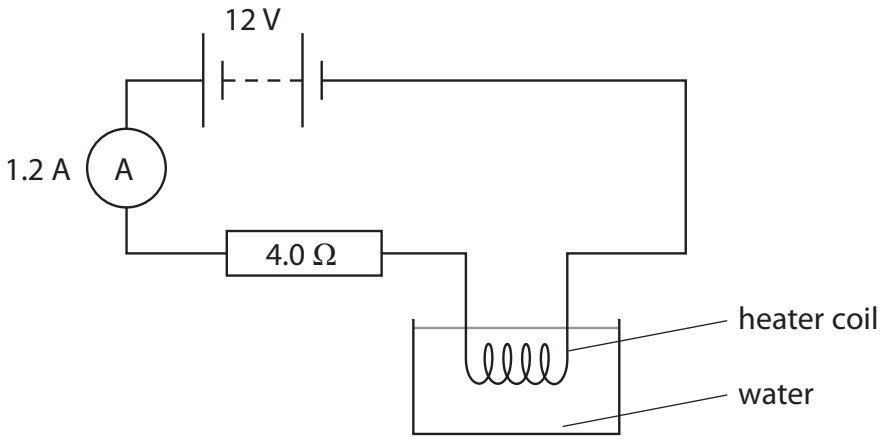
8 The diagram shows a heater coil and a resistor connected to a 12 V battery and an ammeter. The ammeter reading is 1.2 A.



(a) (i) State the equation linking voltage, current and resistance.

(1)

(ii) Calculate the voltage across the 4.0 Ω resistor.

(2)

Voltage = ... V

(iii) Show that the voltage across the heater coil is about 7 V.

(2)

(iv) Calculate the energy transferred to the heater coil in 5.0 minutes.

(3)

Energy transferred = ... J

(v) At first, the temperature of the water increases.

After a while, the temperature reaches a steady value below the boiling point of water.

Explain why the temperature reaches a steady value.

(2)

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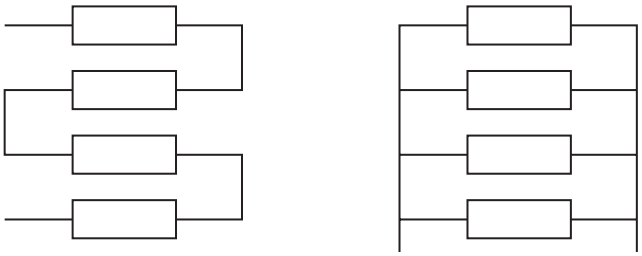
(b) Resistors can be used as heating elements in the rear windows of cars.

The diagram shows two possible designs.



X **Y**

(i) Complete the table by placing a tick (✓) in the correct boxes.

(1)

Design	Series	Parallel
X		
Y		

(ii) Describe the advantages and disadvantages of design **X** when used as a heater in a car window.

(3)

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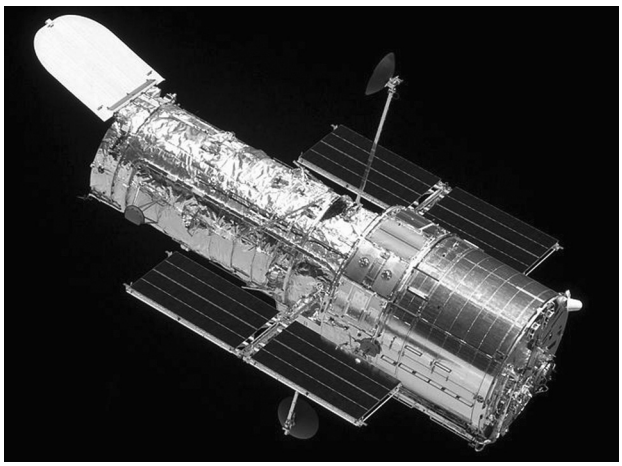
(Total for Question 8 = 14 marks)

9 The Hubble Space Telescope is in orbit around the Earth.

It detects visible light from distant objects.



(a) Name the force that keeps the telescope in orbit around the Earth.

(1)

.....

(b) The Hubble Space Telescope moves in a circular orbit.

Its distance above the Earth's surface is 560 km.

(i) The radius of the Earth is 6400 km.

Calculate the radius of the orbit of the Hubble Space Telescope.

(1)

Radius = ... km

(ii) The Hubble Space Telescope completes one orbit in 96 minutes.

Calculate its orbital speed in m/s.

(3)

Orbital speed = ... m/s

(c) The Chandra Telescope also orbits the Earth, but does not move in a circular orbit.

Its distance from the Earth and its speed change as it orbits the Earth.

It travels fastest when it is closest to the Earth.

Use ideas about energy to explain why.

(3)

(d) The Chandra Telescope detects X-rays from distant objects.

(i) State the name of the type of wave that includes X-rays and visible light.

(1)

(ii) Describe **two** differences between X-rays and visible light.

(2)

1

2

(Total for Question 9 = 11 marks)

10 A shopping centre has escalators to move people between floors.

(a) A man of mass 78 kg steps on to an escalator.

The escalator lifts him a height of 5.0 m.

(i) State the equation linking gravitational potential energy, mass, *g* and height.

(1)

(ii) Show that the gravitational potential energy gained by the man is about 4000 J.

(2)

(iii) State the work done on the man and give the unit.

(2)

Work done = ... Unit .....

(b) The escalator is powered by a 7.5 kW electric motor.

(i) State the equation linking efficiency, useful energy output and total energy input.

(1)

(ii) The escalator lifts 30 people each minute.

Each person has a mass of 78 kg.

Calculate the efficiency of the escalator.

(3)

Efficiency = ...

(c) Another escalator has an efficiency of 20%.

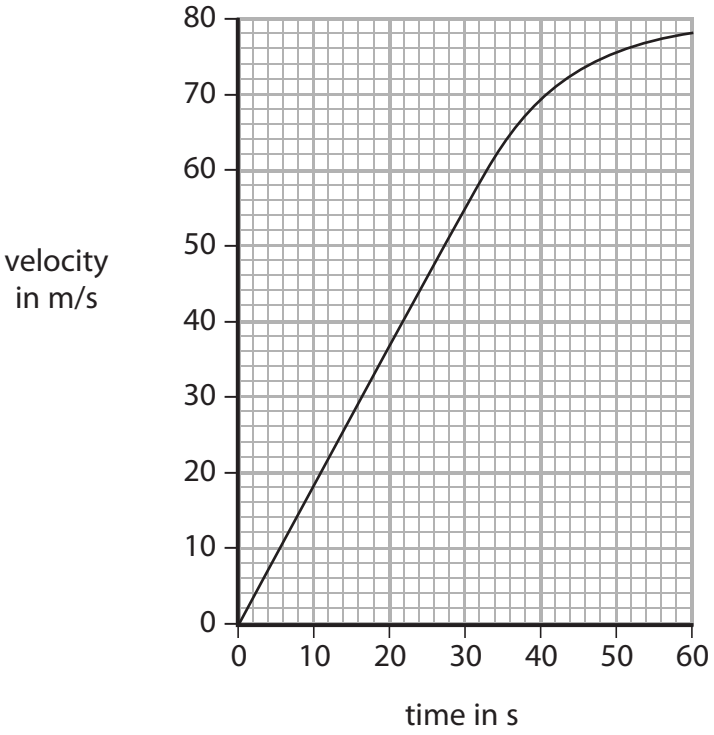
Its input power is 15 kW.

Draw a Sankey diagram for this escalator.

(3)

(Total for Question 10 = 12 marks)

11 The graph shows how the velocity of an aircraft changes as it accelerates along a runway.



(a) Use the graph to find the average acceleration of the aircraft.

(3)

Acceleration = ... m/s^2

(b) Explain why the acceleration is not constant, even though the engines produce a constant force.

(3)

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(Total for Question 11 = 6 marks)

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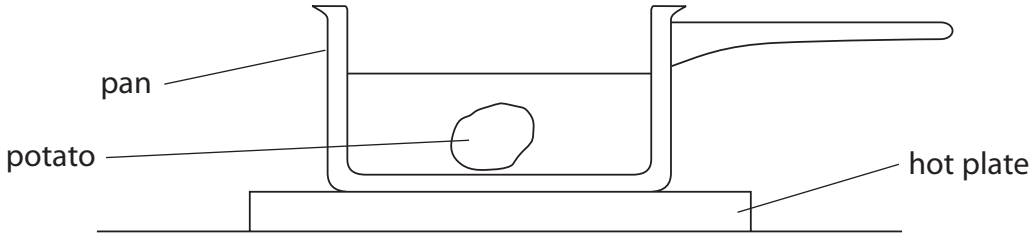
12 This question is about three different methods used to cook potatoes.

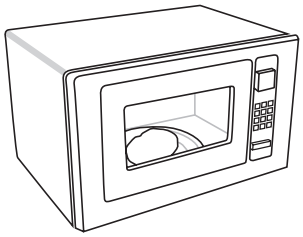
(a) On a traditional cooker, a potato is placed in water in a pan on top of a hot plate.



Describe how energy is transferred from the hot plate to heat up all of the potato.

(4)

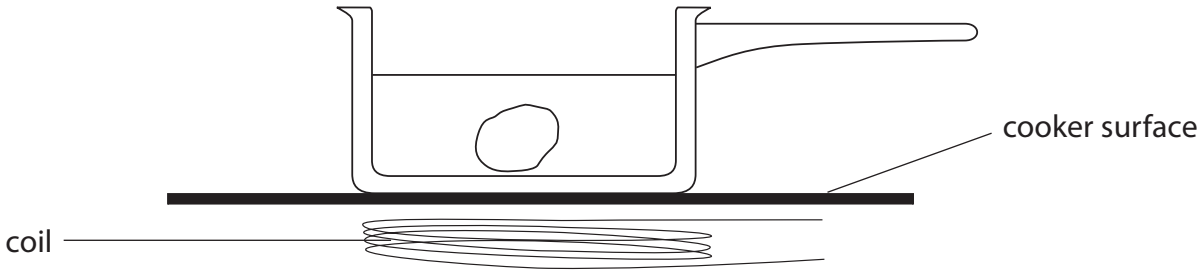
(b) A microwave cooker is often said to *'cook the food from the inside'*.



Explain whether this statement is true by describing how energy is transferred to heat up all of the potato.

(3)

(c) In an induction cooker, there is a coil under the surface of the cooker.



A potato is placed in water in a metal pan.

An alternating current is switched on in the coil under the pan.

The coil does not heat the surface of the cooker.

Describe how energy is transferred to heat up all of the potato.

(5)

(Total for Question 12 = 12 marks)

TOTAL FOR PAPER = 120 MARKS

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