(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)

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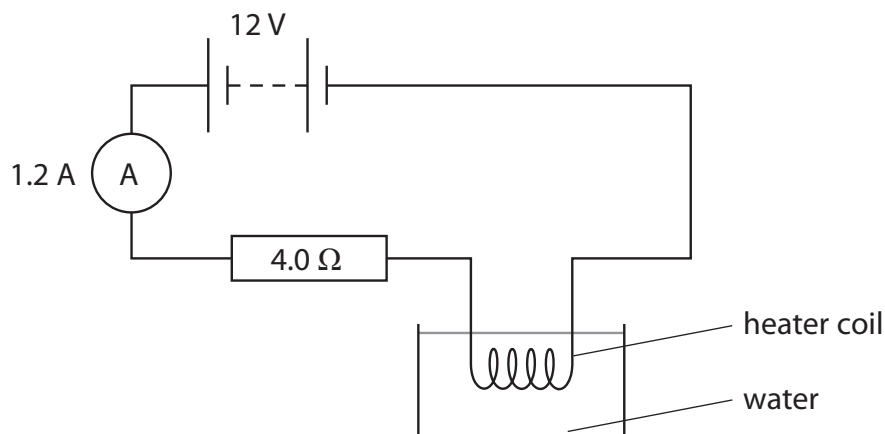**(Total for Question 7 = 13 marks)**

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P 4 0 1 3 8 A 0 1 9 3 2

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.
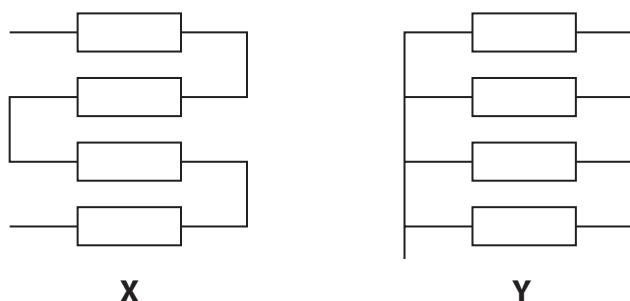
(2)

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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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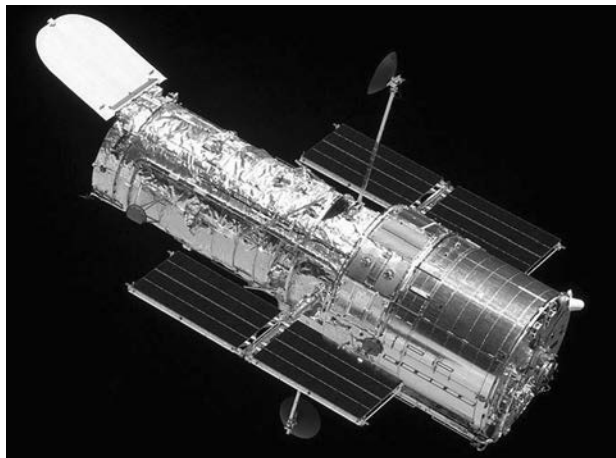
(Total for Question 8 = 14 marks)

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)

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(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)

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(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)

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

(2)

1 ....

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2 ....

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(Total for Question 9 = 11 marks)