

Gateway Science Physics A

J249/02 Physics A P5-P8 and P9 (Foundation Tier)

Question Set 22

A student has two radiators in her home. They are filled with different liquids and have different power ratings.

Fig. 1.1 shows information about the two heaters.



Oil radiator	Water radiator
 <p>Heater contains 10 kg of oil</p>	 <p>Heater contains 10 kg of water</p>
1000 W heater	1500 W heater

Fig. 1.1

Table 1.1 shows information about oil and water.

Material	Specific heat capacity (J/kg °C)	Freezing point (°C)	Boiling point (°C)
Oil	1 700	-24	250
Water	4 200	0	100

Table 1.1

- (a) The student's conservatory can be very cold. Sometimes the temperature can get as low as $-6\text{ }^{\circ}\text{C}$.

She thinks that it may be better to use the oil radiator in the conservatory than the water radiator.

Suggest why.

Use the information in **Table 1.1** to help you answer.

[1]

- (b) Both radiators have a 'cut-out' which prevents them getting hotter than $60\text{ }^{\circ}\text{C}$.

Suggest why.

[1]

- (c) The student knows that the oil heater produces 800 J of energy each second.
Calculate the energy produced by the oil heater in 10 minutes.

Answer = J

[2]

- (d) The student wants the oil heater to heat up by 40°C

- (i) How much energy is needed?

Use the information in **Fig. 22.1** and **Table 22.1** to help you answer.

Show your working.

Answer = J

[2]

- (ii) She supplies enough energy to heat up the oil radiator by 40 °C but it only heats up to 32 °C.

Suggest **two** reasons why.

[2]

Total Marks for Question Set 22: 8

Equations in physics

$$(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$$

$$\text{change in thermal energy} = \text{mass} \times \text{specific heat capacity} \times \text{change in temperature}$$

$$\text{thermal energy for a change in state} = \text{mass} \times \text{specific latent heat}$$

$$\text{energy transferred in stretching} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

$$\text{potential difference across primary coil} \times \text{current in primary coil} = \text{potential difference across secondary coil} \times \text{current in secondary coil}$$

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