Oxford Cambridge and RSA

GCSE Physics B (Twenty First Century Science)

J259/03 Depth in physics (Higher Tier)

Question Set 35

1 Nuclear power stations use uranium-235 as a fuel.

Energy is released from uranium-235 when it undergoes nuclear fission.

Fig. 9.1 shows what happens in nuclear fission.

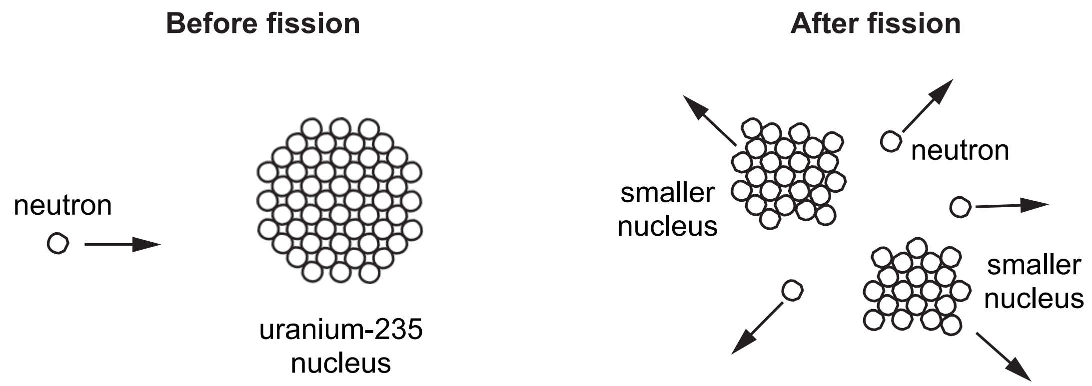


Fig. 9.1

(a) Describe how the energy released during nuclear fission is transferred.

[2]

(b) **Fig. 9.2** below shows a simplified view of a nuclear reactor.

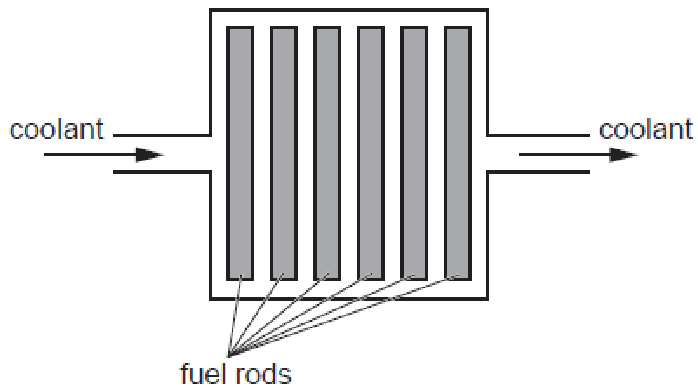


Fig. 9.2

(i) Nuclear fission takes place in the fuel rods. The fuel rods contain uranium.

To release a useful amount of energy, there must be a chain reaction. If only one fuel rod is used, there will not be a chain reaction.

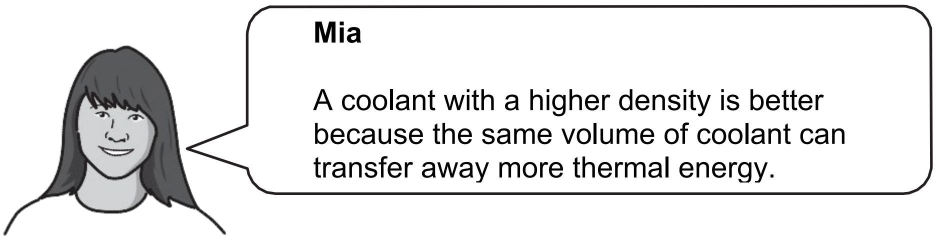
Explain why many fuel rods are needed to cause a chain reaction.

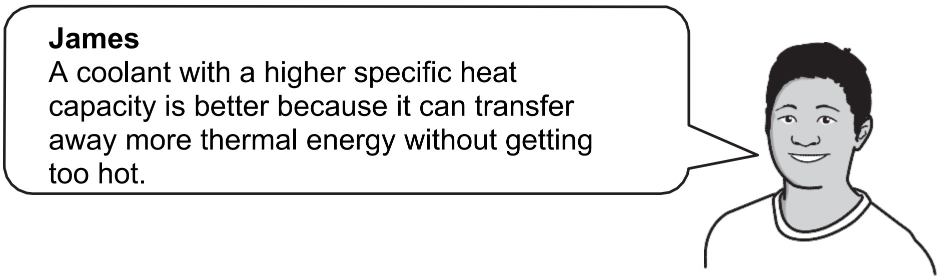
[2]

(ii) Coolant is continually pumped through the reactor. The purpose of the coolant is to remove thermal energy from the reactor.

The table shows two coolants that can be used in nuclear reactors.

Coolant	Approximate specific heat capacity (J / kg °C)	Density (kg / m^3)
A	150	11 000
B	1300	860





Both students are correct that these factors improve the coolant.

Suggest which coolant would be the most suitable to use in a nuclear reactor.

Use data in the table and calculations to support your answer.

[2]

Total Marks for Question Set 35: 6

Resource Materials

Equations in Physics

change in internal energy = mass × specific heat capacity × change in temperature

energy to cause a change in state = mass × specific latent heat

for gases: pressure × volume = constant
(for a given mass of gas and at a constant temperature)

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

energy stored in a stretched spring = ½ × spring constant × $(\text{extension})^2$

potential difference across primary coil × current in primary coil =
potential difference across secondary coil × current in secondary coil

Higher tier only –

pressure due to a column of liquid = height of column × density of liquid × g

force = magnetic flux density × current × length of conductor

**potential difference across primary coil ÷ potential difference across secondary coil =
number of turns in primary coil ÷ number of turns in secondary coil**

change in momentum = resultant force × time for which it acts