

- 4 A student investigates the efficiency of a filament lamp. Fig. 4.1 shows the filament lamp with its glass bulb immersed in water in a beaker.

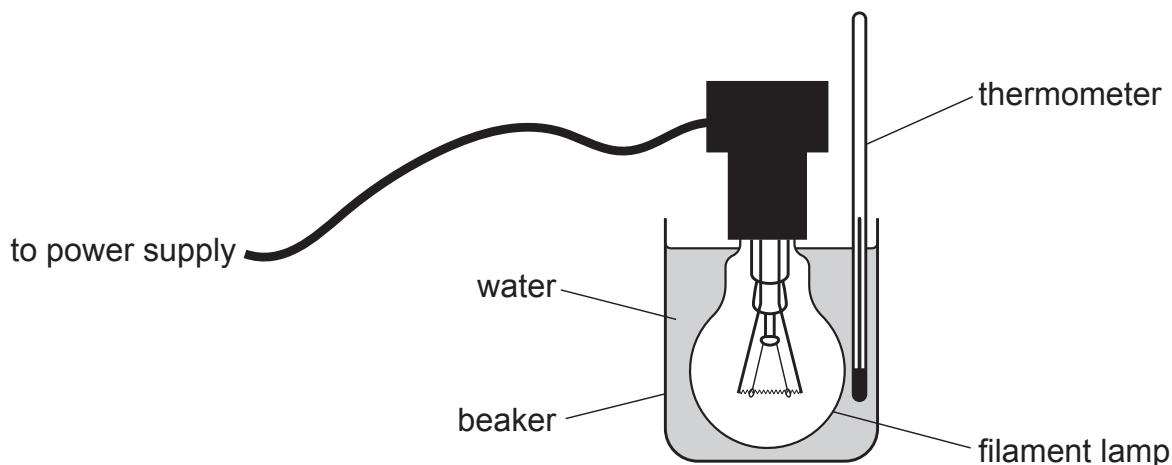


Fig. 4.1

The reading on the thermometer in the water is 19.0°C .

Only the glass of the lamp is in contact with the water and the electrical connections are completely insulated.

The lamp is switched on.

At the end of the experiment, the temperature of the water is 21.5°C .

- (a) The mass of the water in the beaker is 600g and the specific heat capacity of water is $4200\text{J}/(\text{kg}^{\circ}\text{C})$.

- (i) Show that the increase in the internal energy of the water is 6300 J.

[3]

- (ii) In the experiment, the lamp is switched on for 500 s. The power supplied to the filament lamp is 13 W. The useful energy from the lamp is transferred as light. The energy that increases the temperature of the water is wasted energy.

Determine the maximum possible efficiency of the filament lamp.

maximum possible efficiency =

[4]

- (b) The efficiency of the lamp is less than the value determined in (a)(ii).

Suggest **one** reason for this.

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[Total: 8]