# Thermal Properties and Temperature

## Question Paper 7

| Level | IGCSE |
|---|---|
| Subject | Physics |
| ExamBoard | CIE |
| Topic | Thermal Physics |
| Sub-Topic | Thermal Properties and Temperature |
| Paper Type | (Extended) Theory Paper |
| Booklet | Question Paper 7 |

**Time Allowed:** 44 minutes

**Score:** /37

**Percentage:** /100

**1** **(a)** Explain, in terms of molecules, how thermal expansion takes place in a solid and in a gas.

solid ......................................................................................................................................

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gas ........................................................................................................................................

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.................................................................................................................................... [4]

**(b)** Complete Table 5.1 to show the relative expansion of equal volumes of liquids, gases and solids.

Choose words from

**much less**, **slightly less**, **slightly more** and **much more**.                    [2]

| state of matter | expansion compared to solids, for the same temperature rise |
|---|---|
| liquids | |
| gases | |

**Table 5.1**

**(c)** Alcohol is often used in thermometers.

State one property of alcohol that makes it suitable for use in thermometers.

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.................................................................................................................................... [1]

[Total: 7]

**2** Fig. 5.1 shows apparatus that could be used to determine the specific latent heat of fusion of ice.
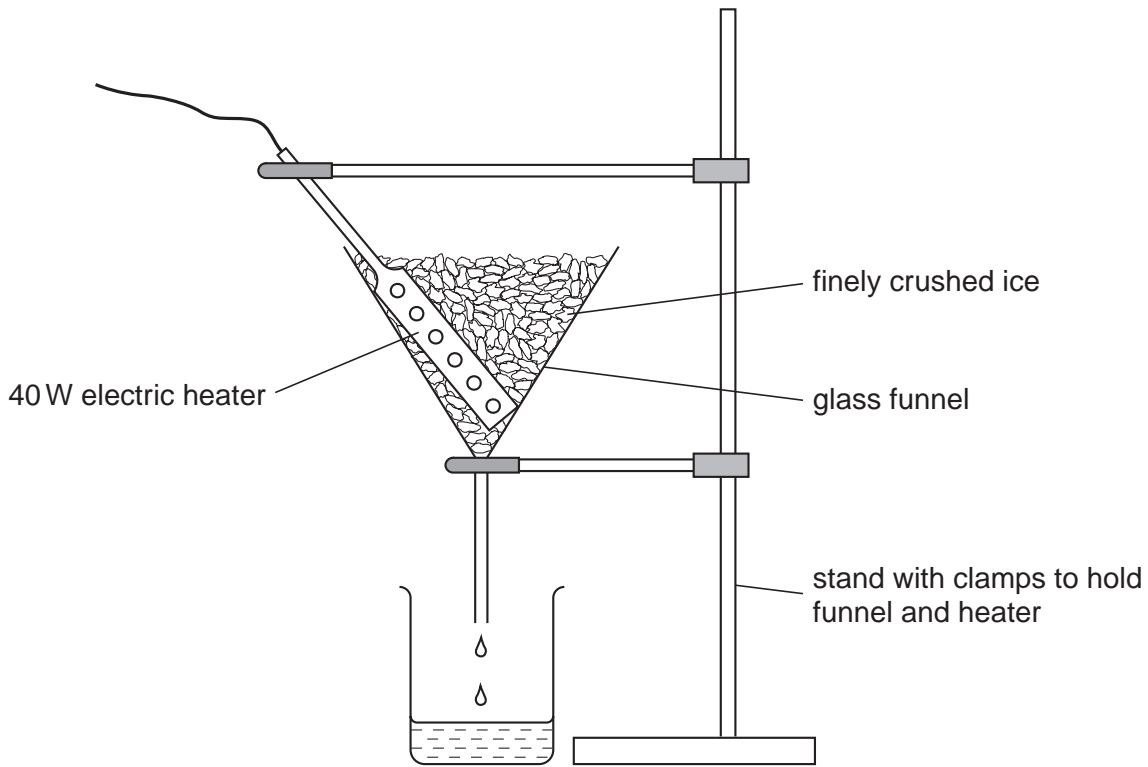


**Fig. 5.1**

**(a)** In order to obtain as accurate a result as possible, state why it is necessary to

**(i)** wait until water is dripping into the beaker at a constant rate before taking readings,

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................................................................................................................................... [1]

**(ii)** use finely crushed ice rather than large pieces.

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................................................................................................................................... [1]

**(b)** The power of the heater and the time for which water is collected are known. Write down all the other readings that are needed to obtain a value for the specific latent heat of fusion of ice.

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....................................................................................................................................... [2]

**(c)** Using a 40 W heater, 16.3 g of ice is melted in 2.0 minutes. The heater is then switched off. In a further 2.0 minutes, 2.1 g of ice is melted.

Calculate the value of the specific latent heat of fusion of ice from these results.

specific latent heat of fusion of ice = ................................................ [4]

[Total: 8]

**3** Fig. 4.1 shows a student's attempt to estimate the specific latent heat of fusion of ice by adding ice at 0 °C to water at 20 °C. The water is stirred continuously as ice is slowly added until the temperature of the water is 0 °C and all the added ice has melted.
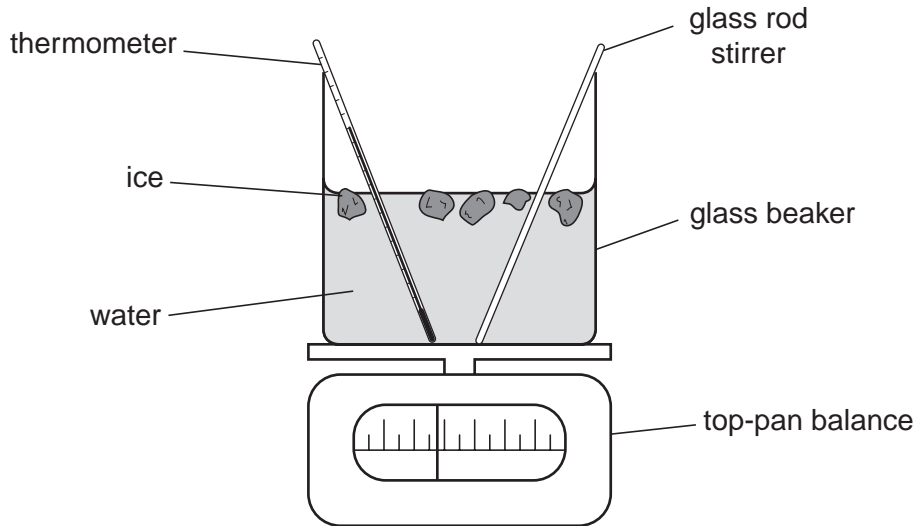


**Fig. 4.1**

**(a)** Three mass readings are taken. A description of the first reading is given.

Write down descriptions of the other two.

reading 1  the mass of the beaker + stirrer + thermometer

reading 2  ...........................................................................................................................................

reading 3  ...................................................................................................................... [2]

**(b)** Write down word equations which the student could use to find

   **(i)** the heat lost by the water as it cools from 20 °C to 0 °C,

   ................................................................................................................................ [1]

   **(ii)** the heat gained by the melting ice.

   ................................................................................................................................ [1]

**(c)** The student calculates that the water loses 12 800 J and that the mass of ice melted is 30 g.

Calculate a value for the specific latent heat of fusion of ice.

specific latent heat of fusion = ................................................ [2]

**(d)** Suggest two reasons why this value is only an approximate value.

Reason 1 ...........................................................................................................................

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Reason 2 ...........................................................................................................................

............................................................................................................................................ [2]

[Total: 8]

**4** **(a)** State two differences between evaporation of water and boiling of water.

1. ...............................................................................................................................

2. ...........................................................................................................................[2]

**(b)** The specific latent heat of vaporisation of water is 2260 kJ / kg.
Explain why this energy is needed to boil water and why the temperature of the water does not change during the boiling.

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...........................................................................................................................[3]

**(c)** A laboratory determination of the specific latent heat of vaporisation of water uses a 120 W heater to keep water boiling at its boiling point. Water is turned into steam at the rate of 0.050 g/s.
Calculate the value of the specific latent heat of vaporisation obtained from this experiment. Show your working.

specific latent heat of vaporisation = .......................[3]

[Total : 8]

**5** **(a)** Fig. 5.1 shows a tank used for evaporating salt solution to produce crystals.


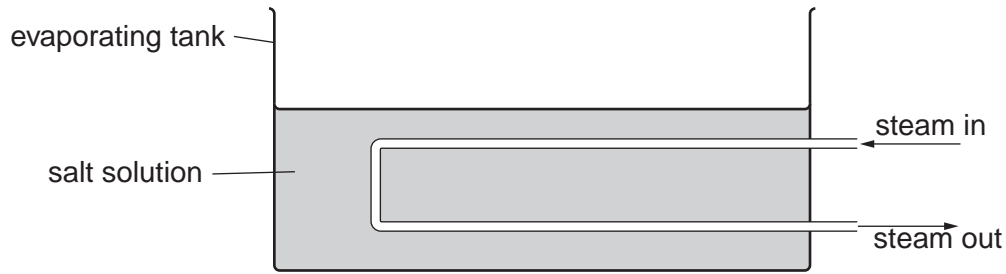
evaporating tank
steam in
salt solution
steam out

**Fig. 5.1**

Suggest two ways of increasing the rate of evaporation of the water from the solution. Changes may be made to the apparatus, but the rate of steam supply must stay constant. You may assume the temperature of the salt solution remains constant.

1. ...........................................................................................................................................

..............................................................................................................................................

2. ...........................................................................................................................................

...................................................................................................................................... [2]

**(b)** A manufacturer of liquid-in-glass thermometers changes the design in order to meet new requirements.

Describe the changes that could be made to

**(i)** give the thermometer a greater range,

.................................................................................................................................. [1]

**(ii)** make the thermometer more sensitive.

.................................................................................................................................. [1]

**(c)** A toilet flush is operated by the compression of air. The air inside the flush has a pressure of $1.0 \times 10^5$ Pa and a volume of $150 \, cm^3$. When the flush is operated the volume is reduced to $50 \, cm^3$. The temperature of the air remains constant during this process.
Calculate the new pressure of the air inside the flush.

pressure = ....................... [2]

[Total : 6 ]