

AQA GCSE PHYSICS (HIGHER) • 8463

PHYSICS



EXAM QUESTION PACK

4.3.2.3 CHANGES OF HEAT AND SPECIFIC LATENT HEAT (PACK 2)

SCORE

/42

PERCENTAGE

%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

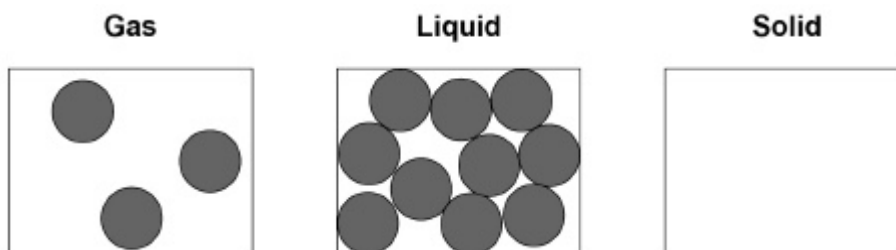
Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

The diagram shows a model of the particles in a gas and in a liquid.



- (a) Complete the diagram to show the arrangement of particles of the same substance as a solid.

(2)

- (b) What is the name of the process when a substance changes from a gas to a liquid?

Tick **one** box.

Condensing	☐
Evaporating	☐
Freezing	☐
Melting	☐

(1)

- (c) The substance in the diagram has a:

- melting point of 98 °C
- boiling point of 883 °C

What is the state of the substance at 20 °C?

Tick **one** box.

Gas	☐	Liquid	☐	Solid	☐
-----	--------------------------	--------	--------------------------	-------	--------------------------

(1)

- (d) What type of change is a change of state?

Tick **one** box.

Chemical	☐
Kinetic	☐

Permanent

☐

Physical

☐

(1)

- (e) Which **two** statements are correct about the particles when a liquid turns into a gas?

Tick **two** boxes.

Particles are bigger

☐

Particles are lighter

☐

Particles have more chemical energy

☐

Particles have more kinetic energy

☐

Particles move faster

☐

(2)

- (f) Which **two** quantities are needed to calculate the energy required to turn a liquid into a gas with no change in temperature?

Tick **two** boxes.

Mass of the liquid

☐

Specific heat capacity of the gas

☐

Specific latent heat of vaporisation

☐

Time the liquid is heated

☐

(2)

- (g) A mass of 2.0 kg of water is heated.

The temperature increase of the water is 80 °C

The specific heat capacity of water is 4200 J / kg °C

Calculate the change in thermal energy when the water is heated.

Use the equation:

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

Change in thermal energy = _____ J

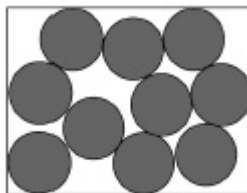
(2)

(Total 11 marks)

Q2.

Figure 1 shows a model of the particles in a liquid.

Figure 1



- (a) Give **one** similarity and **one** difference you would see in **Figure 1** if it showed the same substance as a gas.

Similarity _____

Difference _____

(2)

- (b) Describe **two** limitations of the model shown in **Figure 1**.

1. _____

2. _____

(2)

- (c) Explain why substances have different melting points.

(2)

- (d) Some fire extinguishers contain liquid carbon dioxide.

Suggest how carbon dioxide gas can be changed to liquid carbon dioxide without reducing its temperature.

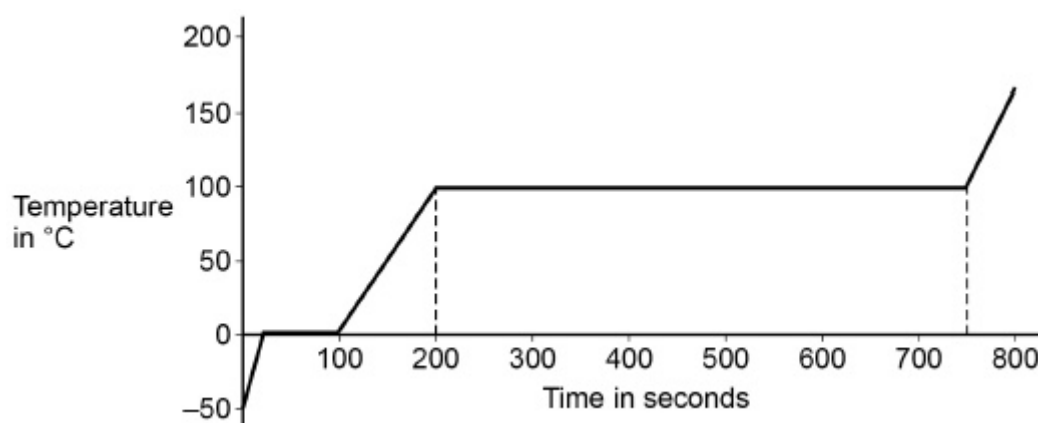
(1)

Ice was heated at a constant rate.

Eventually all the ice changed to a gas.

Figure 2 shows how the temperature changed over 800 seconds.

Figure 2



- (e) What change of state occurs between 200 seconds and 750 seconds?

(1)

- (f) Explain how **Figure 2** shows that the specific latent heat of vaporisation is greater than the specific latent heat of fusion.

Use data from **Figure 2**.

(2)

- (g) 1695 kJ of energy is transferred to water at 100 °C

The specific latent heat of vaporisation of water is $2.260 \times 10^6 \text{ J / kg}$

Calculate the mass of water changed into a gas at 100 °C

Use the Physics Equations Sheet.

Mass of water = _____ kg

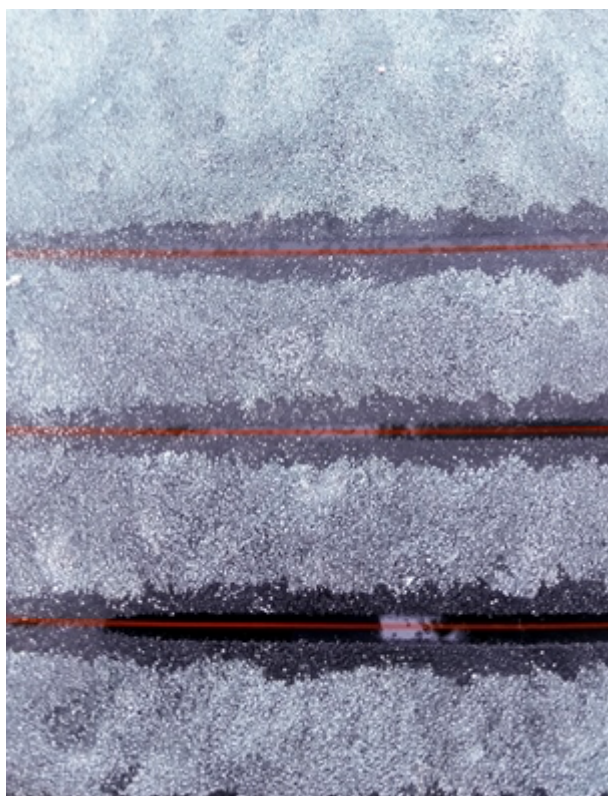
(3)

(Total 13 marks)

Q3.

Figure 1 shows solid ice on a car's rear window.

Figure 1

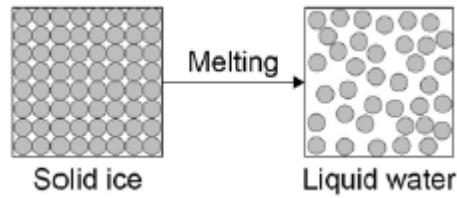


© Captive cookies/iStock/Thinkstock

The glass window contains an electrical heating element.

- (a) Use the particle model in **Figure 2** to describe how the heating element causes the arrangement of the ice particles to change as the ice melts.

Figure 2



You should include a description of how the particles are arranged in the solid ice and in the water.

(6)

- (b) A car manufacturer tests different heating elements by measuring how long it takes ice to melt.

During the test some variables must be controlled.

Identify **two** control variables in the car manufacturer's test.

Tick **two** boxes.

The colour of the car

☐

The current in the heating element

☐

The mass of ice

☐

The size of the car

☐

The time taken for the ice to melt

☐

(2)

- (c) Some of the energy supplied by the heater causes the ice to melt without the temperature of the ice increasing.

What is the name given to this energy supplied by the heater?

Tick **one** box.

Latent heat of freezing

☐

Latent heat of fusion

☐

Latent heat of vaporisation

☐

(1)

- (d) When the heater is supplied with 120 J of energy each second, the internal energy of the ice increases by 45 J each second.

Use the following equation to calculate the efficiency of the heater.

$$\text{Efficiency} = \frac{\text{Output energy transfer}}{\text{input energy transfer}}$$

Give your answer to two decimal places.

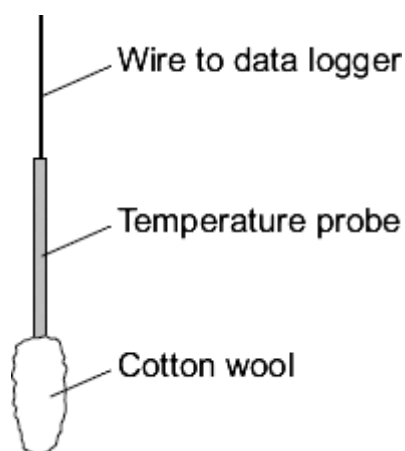
Efficiency = _____

(2)

(Total 11 marks)

Q5.

A student investigated the evaporation of three different liquids using the apparatus shown.

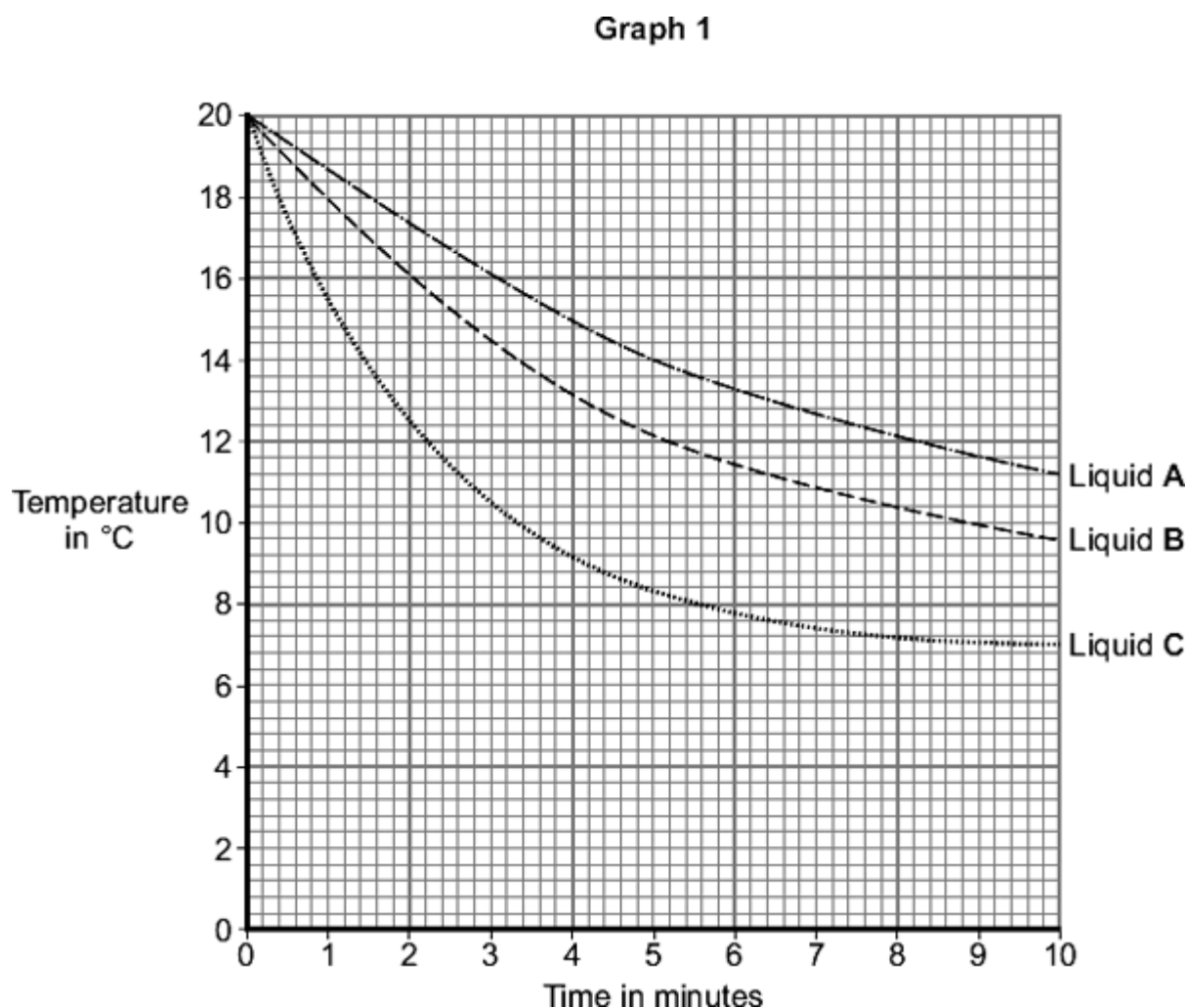


Identical pieces of cotton wool were soaked in one of three liquids, **A**, **B** or **C**, that have different boiling points. The same volume of liquid, at the same starting temperature, was

used each time.

The temperature of the cotton wool was measured during a ten minute period.

The results are shown on **Graph 1**.



- (a) Which liquid has the lowest boiling point?

Explain your choice.

Liquid _____

Explanation _____

(2)

- (b) Room temperature is 20 °C.

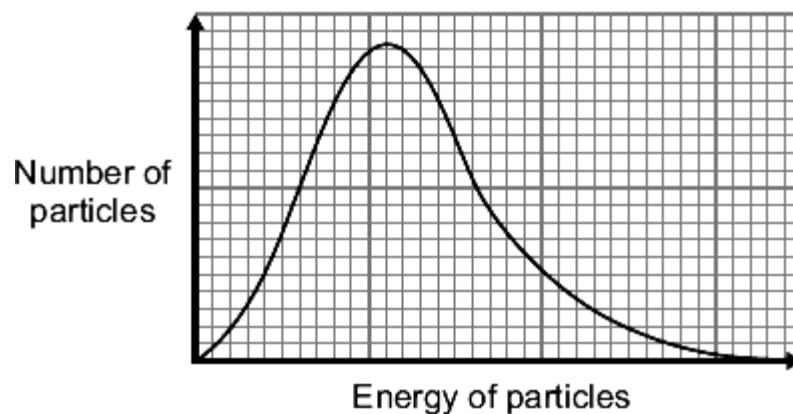
The line for liquid **C** reached a lower limit of 7 °C.

Explain why the temperature did **not** fall below 7 °C.

(1)

- (c) **Graph 2** shows the distribution of energy among particles in a liquid.

Graph 2



Explain, in terms of the particles in a liquid, why evaporation causes cooling.

You may use information from **Graph 2** to help you with your answer.

(4)

(Total 7 marks)

Mark schemes

Q1.

- (a) (approximate same size particles as each other and as liquid and gas) touching
*do **not** accept particles that overlap* 1
- regular arrangement (filling the square) 1
- (b) condensing 1
- (c) solid 1
- (d) physical 1
- (e) particles have more kinetic energy 1
- particles move faster 1
- (f) mass of the liquid 1
- specific latent heat of vaporisation 1
- (g) $2 \times 4\ 200 \times 80$ 1
- 672 000 (J)
an answer of 672 000 (J) scores 2 marks 1
- [11]

Q2.

- (a) (similarity) same size / shape particles 1
- (difference) further apart / fewer in same area
allow none / not many touching 1
- (b) any **two** from:
• no movement shown
• atoms / molecules / ions / particles are not solid spheres
• no forces between the spheres
• only 2D 2
- (c) • different forces between particles
allow substances have different types of bond

		1
•	(so) different amounts of energy required (to break forces)	1
(d)	high(er) pressure (within fire extinguisher)	1
(e)	liquid to gas	1
(f)	(change from solid to liquid) 80 seconds	
	and	
	(change from liquid to gas) takes 550 seconds	1
	(therefore) takes longer so more (thermal) energy is supplied (to change state)	1
(g)	$1\,695\,000 = m \times 2.260 \times 10^6$	1
	$m = \frac{1\,695\,000}{2.260 \times 10^6}$	1
	0.75	
	<i>an answer of 0.75 scores 3 marks</i>	
	<i>allow conversion of kJ to J</i>	1

[13]

Q3.

(a) **Level 3 (5–6 marks):**

A clear, logical explanation containing accurate ideas presented in the correct order with links between ideas.

Level 2 (3–4 marks):

Key ideas presented with some linked together to form a partial explanation.

Level 1 (1–2 marks):

Fragmented ideas, some may be relevant, insufficient links to form an explanation.

0 marks:

No relevant content.

Indicative content

- current in the wire causes heating
- increases temperature of the metal wires / ice

Solid

- arrangement of particles is regular
- particles vibrate about a fixed position

Melting

- internal energy of the ice increases, increasing the temperature to melting point
- so (as the temperature increases) particles vibrate faster
- eventually particles vibrate fast enough to break free from the (strong) bonds
- therefore the arrangement of particles becomes irregular

Liquid

- arrangement of particles is irregular
- particles movement (translational) is random

6

(b) The current in the heating element

1

The mass of ice

1

(c) latent heat of fusion

1

$$45 / 120 = 0.375$$

1

0.38

allow 0.38 with no working shown for 2 marks

allow 0.375 with no working shown for 1 mark

1

[11]

Q5.

(a) (liquid C)

no mark awarded for stating liquid C

no marks awarded if liquid A or B chosen

(causes) biggest temperature decrease

allow cools quicker / the quickest

1

(because it) evaporates quickest

allow evaporates quicker

allow most / more evaporated

ignore references to boiling

1

(b) all of the liquid has evaporated

accept no net energy transfer

allow it was dry

1

(c) particles with most energy / highest speed evaporate

allow hottest particles

1

these particles escape from the (surface of the) liquid <i>accept overcoming the attractive forces (between particles)</i>	1
decreasing mean energy of particles (left in liquid) <i>allow some reference to the total energy of the liquid reducing</i>	1
which lowers the temperature <i>ignore cool down</i>	1

[7]

Examiner reports

Q5.

- (a) A large number of students gave liquid A as their answer, so gained zero marks. The most common correct answer was that liquid C cooled the quickest. Some thought it was being heated and there were a lot of references to boiling.
- (b) Very few students gave a correct response. Most said that the room temperature prevented it cooling further, or that room temperature was 7 °C. There were many incorrect references to boiling or freezing points, condensing and turning to a liquid. A poor understanding of cooling by evaporation and change of state was demonstrated.
- (c) Many students did not understand the graph which led to confused responses. It was clear that evaporation is not well understood. Few students realised that the particles with the most energy evaporated. The most common mark gained was for particles escaping from the liquid. Some students gave descriptions referring to the total energy of the liquid reducing but few went on to mention that this lowered the temperature of the liquid. They usually just repeated information given in the question and said the liquid cooled down, which was not enough for the last marking point.