

GCSE Combined Science: Trilogy

Worksheet: Changes of state and specific latent heat

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Changes of state and specific latent heat

NAME

CLASS

DATE

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

specific latent heat of fusion of aluminium = 397 000 J/kg

01.1

Calculate the energy needed to melt 0.5 kg of aluminium at its melting point.

Use the equation:

thermal energy for a change of state = mass × specific latent heat

Energy = J

[2 marks]

0 2

0 2 . 1

What is meant by the specific latent heat of a substance?

Tick (✓) **one** box.

The energy needed to change the state of 1 kg of the substance with no change in temperature ☐

The energy needed to raise the temperature of 1 kg of the substance by 1 °C ☐

The temperature at which the substance changes state ☐

The total energy of all the particles in the substance ☐

[1 mark]

0 2 . 2

What is the name of the specific latent heat for a change of state from liquid to vapour?

Tick (✓) **one** box.

Specific latent heat of condensation ☐

Specific latent heat of fusion ☐

Specific latent heat of vaporisation ☐

Specific heat capacity ☐

[1 mark]

0 2 . 3

Calculate the energy needed to melt 0.25 kg of ice at 0 °C.

specific latent heat of fusion of ice = 334 000 J/kg

Use the equation:

thermal energy for a change of state = mass × specific latent heat

.....

.....

.....

.....

Energy = J

[2 marks]

0 3

Stearic acid is a waxy solid used to make candles.

specific latent heat of fusion of stearic acid = 199 000 J/kg

0 3 . 1

Calculate the energy released when 0.40 kg of liquid stearic acid solidifies (freezes) at its melting point.

Use the equation:

thermal energy for a change of state = mass $\times$ specific latent heat

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Energy = J

[2 marks]

0 3 . 2

State what happens to the temperature of the stearic acid while it is solidifying.

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[1 mark]

0 4

specific latent heat of fusion of ice = 334 000 J/kg

0 4 . 1

Calculate the energy needed to melt 1 kg of ice at its melting point.
Use the equation:
thermal energy for a change of state = mass × specific latent heat

.....

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Energy = J

[2 marks]

0 5

Table 1 shows the specific latent heat of fusion of four substances.

Table 1

Substance	Specific latent heat of fusion in J/kg
Ice	334 000
Aluminium	397 000
Lead	23 000
Copper	205 000

0 5 . 1

Which substance in Table 1 needs the least energy to melt 1 kg of it, once it has reached its melting point?

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[1 mark]

0 5 . 2

Calculate the energy needed to melt 0.25 kg of aluminium, once it has reached its melting point.
Use the Physics Equations Sheet.

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Energy = J

[2 marks]

0 5 . 3

A 0.25 kg block of lead and a 0.25 kg block of copper are both at their melting points.
Calculate how much **more** energy is needed to melt the copper block than the lead block.

.....

.....

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.....

Extra energy = J

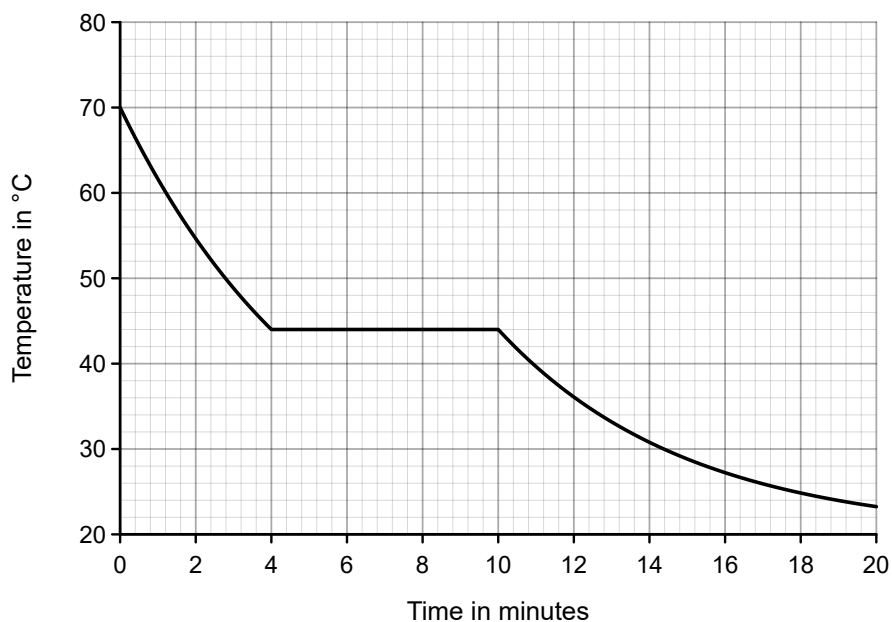
[2 marks]

.....

0 6

A student heated a test tube containing 0.020 kg of solid lauric acid until it had all melted. The student then let the liquid cool and measured its temperature every 30 seconds. Figure 1 shows the results.

Figure 1



0 6 . 1

What is the melting point of lauric acid?

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Melting point = °C

[1 mark]

0 6 . 2

Explain why the temperature of the lauric acid stayed constant between 4 minutes and 10 minutes, even though energy was being transferred to the surroundings.

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[3 marks]

0 6 . 3

specific latent heat of fusion of lauric acid = 180 000 J/kg
Calculate the energy transferred to the surroundings as the lauric acid changed from a liquid to a solid.
Use the Physics Equations Sheet.

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Energy = J

[2 marks]

0 6 . 4

Calculate the average rate at which energy was transferred to the surroundings while the lauric acid was solidifying.

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.....

.....

Rate of energy transfer = W

[2 marks]

0 7

Lead melts at 327 °C.

9200 J of energy is needed to melt a 0.40 kg block of lead that is already at 327 °C.

0 7 . 1

Calculate the specific latent heat of fusion of lead.

Use the Physics Equations Sheet.

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Specific latent heat = J/kg

[2 marks]

0 7 . 2

Explain the difference between specific heat capacity and specific latent heat.

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.....

[2 marks]

0 7 . 3

Before it melted, the block was heated from 20 °C to 327 °C.

specific heat capacity of lead = 130 J/kg °C

Calculate the energy needed to heat the block from 20 °C to 327 °C.

Use the Physics Equations Sheet.

.....

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.....

Energy = J

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Changes of state and specific latent heat · 30 marks

Question 1 (2 marks)

01.1 [2 marks]

Answer: 198 500 J

- $\Delta E = 0.5 \times 397\,000$ (1)
 - 198 500 (J) (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: The energy needed to change the state of 1 kg of the substance with no change in temperature

02.2 [1 mark]

Correct: Specific latent heat of vaporisation

02.3 [2 marks]

Answer: 83 500 J

- $E = 0.25 \times 334\,000$ (1)
 - 83 500 (J) (1)
-

Question 3 (3 marks)

03.1 [2 marks]

Answer: 79 600 J

- $\Delta E = 0.40 \times 199\,000$ (1)
 - 79 600 (J) (1)
-

03.2 [1 mark]

Answer: It stays the same.

- it stays the same / constant (1)
-

Question 4 (2 marks)

04.1 [2 marks]

Answer: 334 000 J

- $\Delta E = 1 \times 334\,000$ (1)
 - 334 000 (J) (1)
-

Question 5 (5 marks)

05.1 [1 mark]

Answer: Lead.

- lead (1)
-

05.2 [2 marks]

Answer: 99 250 J

- $\Delta E = 0.25 \times 397\,000$ (1)
 - 99 250 (J) (1)
-

05.3 [2 marks]

Answer: 45 500 J

- extra energy = $0.25 \times (205\,000 - 23\,000)$ (1)
 - = 45 500 (J) (1)
-

Question 6 (8 marks)

06.1 [1 mark]

Answer: 44 °C

- 44 (°C) (allow 43–45) (1)

06.2 [3 marks]

Answer: The lauric acid was freezing. The energy transferred to the surroundings came from the potential energy of the particles as bonds formed, not from their kinetic energy, so the temperature did not fall.

- the lauric acid was changing state / freezing / solidifying (1)
- the energy transferred to the surroundings came from a decrease in the potential energy of the particles / internal energy (as bonds formed between the particles) (1)
- the (average) kinetic energy of the particles did not change, so the temperature stayed the same (1)

06.3 [2 marks]

Answer: 3600 J

- $E = 0.020 \times 180\,000$ (1)
- 3600 (J) (1)

06.4 [2 marks]

Answer: 10 W

- $\text{time} = 6 \times 60 = 360$ (s) (1)
- $P = 3600 \div 360 = 10$ (W) (1)

Notes: Allow ECF from the energy calculated. Allow an answer in J/s.

Question 7 (6 marks)

07.1 [2 marks]

Answer: 23 000 J/kg

- $9200 = 0.40 \times L$ (1)
 - $L = 23\,000$ (J/kg) (1)
-

07.2 [2 marks]

Answer: Specific heat capacity is the energy needed to raise the temperature of 1 kg by 1 °C; specific latent heat is the energy needed to change the state of 1 kg without changing its temperature.

- specific heat capacity is the energy needed to raise the temperature of 1 kg (of a substance) by 1 °C (1)
 - specific latent heat is the energy needed to change the state of 1 kg (of a substance) with no change in temperature (1)
-

07.3 [2 marks]

Answer: 16 000 J (15 964 J)

- $\Delta E = 0.40 \times 130 \times 307$ (1)
 - $15\,964$ (J) / $16\,000$ (J) (1)
-