AQA - Internal energy and energy transfer – GCSE Combined Science Physics

1. May/2020/Paper_1F/No.4(4.5_4.8)

0 4 . 5   The air in the balloon had a mass of 0.00320 kg

The temperature of the air in the balloon decreased by 215 °C

The change in thermal energy of the air in the balloon was 860 J

Calculate the specific heat capacity of the air in the balloon.

Use the Physics Equations Sheet.

[3 marks]

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Specific heat capacity = _____ J/kg°C

0 4 . 6   The liquid nitrogen boiled.

What happens to the temperature of nitrogen as it boils?

[1 mark]

Tick (✓) **one** box.

Temperature decreases ☐

Temperature increases ☐

Temperature stays the same ☐

The scientist recorded measurements to calculate the specific latent heat of vaporisation of nitrogen.

0 4 . 7   What is meant by vaporisation?

[1 mark]

Tick (✓) **one** box.

A change of state from liquid to gas ☐

A change of state from solid to gas ☐

A change of state from solid to liquid ☐

0 4 . 8   The mass of nitrogen that vaporised was 0.0072 kg

1440 J of energy was transferred to the nitrogen as it vaporised.

Calculate the specific latent heat of vaporisation of nitrogen.

Use the Physics Equations Sheet.

[3 marks]

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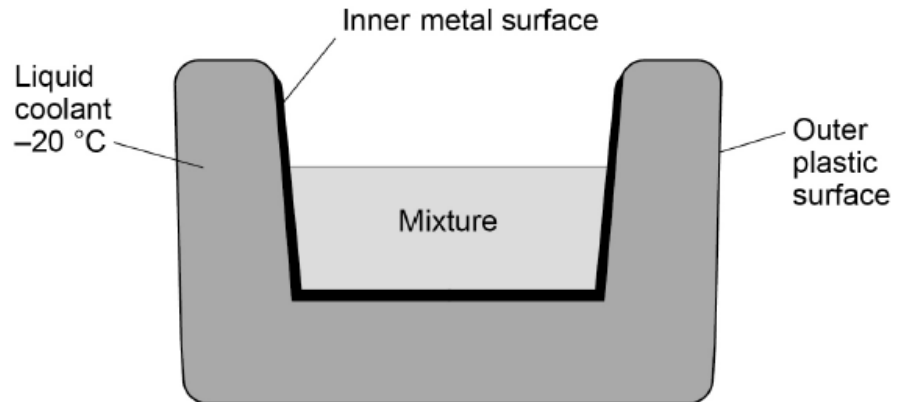Specific latent heat of vaporisation = _____ J/kg

2. May/2020/Paper_1H/No.5(5.3_5.5)

Figure 6 shows a bowl used for making ice cream.

The walls of the bowl contain a liquid coolant.

The bowl is cooled to −20 °C before the mixture is put in the bowl.

The bowl causes the mixture to cool down and freeze.

Figure 6

| 0 | 5 | . | 3 | Explain why the different thermal conductivities of metal and plastic are important in the design of the bowl.

[4 marks]

Metal _____

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Plastic _____

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0 5 . 4 The liquid coolant has a freezing point below −20 °C

Explain **one** other property that the liquid coolant should have.

[2 marks]

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0 5 . 5 The initial temperature of the mixture was +20 °C. The mixture froze at −1.5 °C.

A total of 165 kJ of internal energy was transferred from the mixture to cool and freeze it.

specific heat capacity of the mixture = 3500 J/kg °C

specific latent heat of fusion of the mixture = 255 000 J/kg

Calculate the mass of the mixture.

Give your answer to 2 significant figures.

[6 marks]

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Mass (2 significant figures) = _____ kg

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3. May/2019/Paper_1F/No.7

| 0 | 7 |

A scientist cooled the air inside a container.

| 0 | 7 |.| 1 |

The temperature of the air changed from 20 °C to 0 °C

The volume of the container of air stayed the same.

Explain how the motion of the air molecules caused the pressure in the container to change as the temperature decreased.

[3 marks]

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| 0 | 7 |.| 2 |

The air contained water that froze at 0 °C

The change in internal energy of the water as it froze was 0.70 kJ

The specific latent heat of fusion of water is 330 kJ/kg

Calculate the mass of ice produced.

Use the Physics Equations Sheet.

[3 marks]

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Mass of ice = _____ kg

| 0 | 7 |.| 3 | The air also contained oxygen, nitrogen and carbon dioxide.

Oxygen boils at −183 °C and freezes at −218 °C
Nitrogen boils at −195 °C and freezes at −210 °C
Carbon dioxide sublimates at −78 °C

The scientist continued to cool the air to a temperature of −190 °C

What is the state of each substance at −190 °C?

[2 marks]

Tick (✓) **one** box for **each** row of the table.

Substance	Solid	Liquid	Gas
Oxygen			
Nitrogen			
Carbon dioxide			

0 7 . 4 The air also contained a small amount of argon.

As the temperature of the air decreased from 20 °C to −190 °C the argon changed from a gas to a liquid to a solid.

Explain the changes in the arrangement and movement of the particles of the argon as the temperature of the air decreased.

[6 marks]

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4. May/2019/Paper_1H/No.2(2.1_2.3)

| 0 | 2 |

A scientist cooled the air inside a container.

| 0 | 2 |.| 1 |

The temperature of the air changed from 20 °C to 0 °C

The volume of the container of air stayed the same.

Explain how the motion of the air molecules caused the pressure in the container to change as the temperature decreased.

[3 marks]

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| 0 | 2 |.| 2 |

The air contained water that froze at 0 °C

The change in internal energy of the water as it froze was 0.70 kJ

The specific latent heat of fusion of water is 330 kJ/kg

Calculate the mass of ice produced.

Use the Physics Equations Sheet.

[3 marks]

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Mass of ice = _____ kg

0 2 . 3 The air also contained oxygen, nitrogen and carbon dioxide.

Oxygen boils at −183 °C and freezes at −218 °C
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Carbon dioxide sublimates at −78 °C

The scientist continued to cool the air to a temperature of −190 °C

What is the state of each substance at −190 °C?

[2 marks]

Tick (✓) **one** box for **each** row of the table.

Substance	Solid	Liquid	Gas
Oxygen			
Nitrogen			
Carbon dioxide			

5. May/2019/Paper_1H/No.5(5.3_5.5)

Figure 5 shows how the mass of water in the kettle affected the time taken for the kettle to switch off.

Figure 5
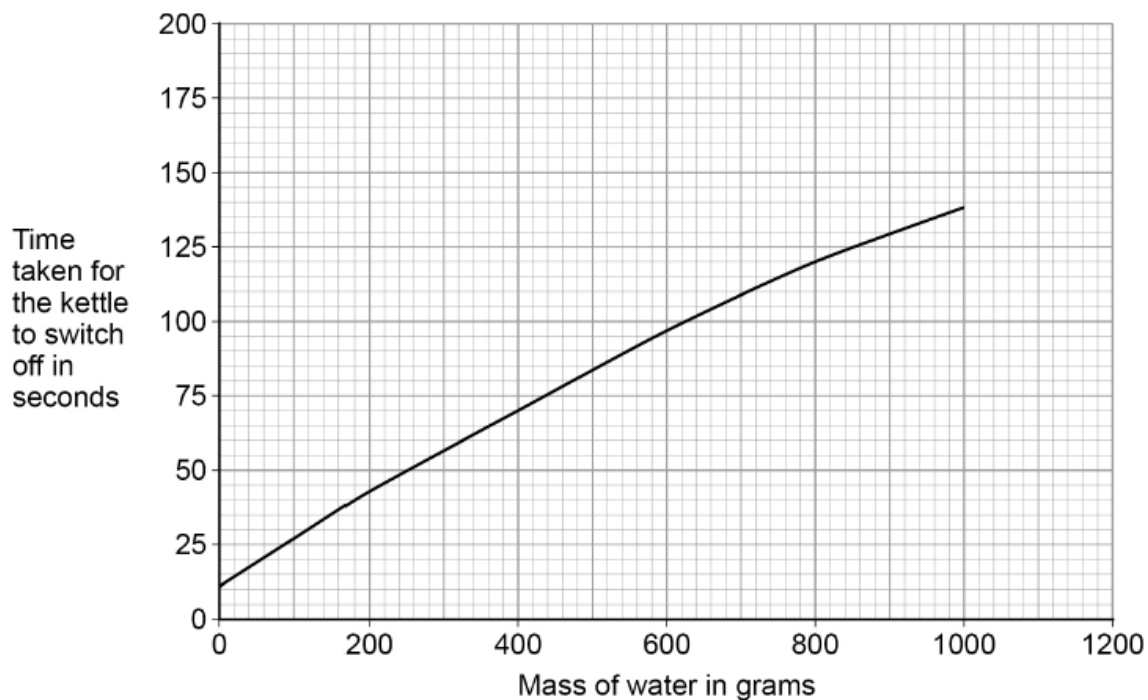
| 0 | 5 | . | 3 | Suggest why the line on **Figure 5** does **not** go through the origin.

[1 mark]

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| 0 | 5 | . | 4 | Suggest why the results give a non-linear pattern.

[1 mark]

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| 0 | 5 | . | 5 | The power of the kettle was 2.6 kW

The kettle took 120 seconds to heat 0.80 kg of water from 18 °C to 100 °C

Calculate the specific heat capacity of water using this information.

Give your answer to 2 significant figures.

[6 marks]

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Specific heat capacity = _____ J/kg °C