Thermal Properties of Matter – 2021 O Level 5054

1. Nov/2021/Paper_11/No.13

Less thermal energy is needed to raise the temperature of 1.0 kg of copper by 1.0 °C than is needed to raise the temperature of 1.0 kg of water by 1.0 °C.

Which statement explains this?

A Copper has a higher melting point.

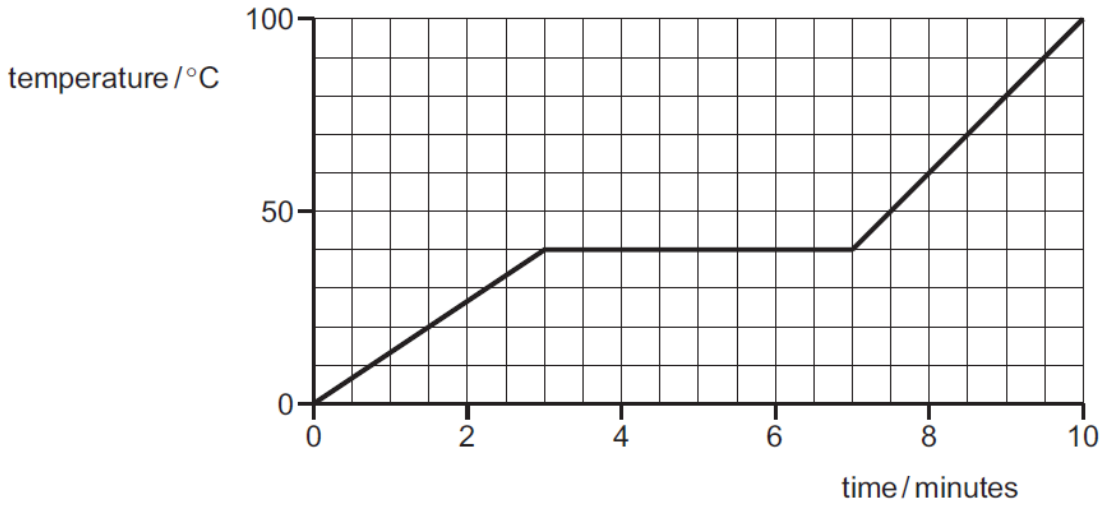
B Copper has a lower specific heat capacity.

C Copper has a smaller specific latent heat.

D Copper is a better conductor of thermal energy.

2. Nov/2021/Paper_11/No.14

The graph is the temperature–time graph for a sample of wax that is heated so that it melts.



The mass of the wax is 200 g.

Thermal energy is supplied to the wax at a constant rate of 12 000 J / minute.

What is the specific latent heat of fusion of the wax?

A 180 J / g **B** 240 J / g **C** 480 J / g **D** 600 J / g

3. Nov/2021/Paper_12/No.16

Which temperatures are used as the lower and upper fixed points for a mercury-in-glass thermometer?

	lower fixed point	upper fixed point
A	freezing point of mercury	boiling point of mercury
B	freezing point of water	boiling point of water
C	room temperature	boiling point of mercury
D	room temperature	boiling point of water

4. Nov/2021/Paper_12/No.17

Two liquid-in-glass thermometers have identical dimensions.

One contains ethanol and the other an equal volume of mercury.

Ethanol expands more than mercury for the same temperature rise.

How do the sensitivity and range of the ethanol thermometer compare to those of the mercury thermometer?

	sensitivity of ethanol thermometer	range of ethanol thermometer
A	greater	greater
B	greater	smaller
C	smaller	greater
D	smaller	smaller

5. Nov/2021/Paper_12/No.18

Solar panels are used to heat water with a mass of 500 kg.

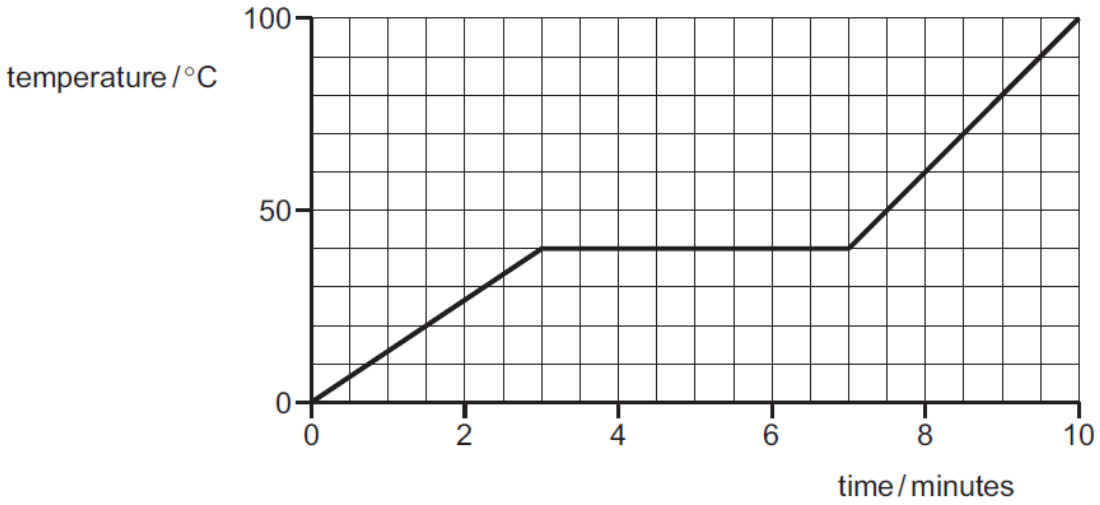
The total area of the solar panels is 10 m^2 and the average power output from each square metre of the panels is 300 W. The specific heat capacity of water is 4200 J / (kg °C).

What is the increase in the water temperature after 8.0 hours? (Assume there is no heat loss.)

A 0.69 °C **B** 4.1 °C **C** 5.1 °C **D** 41 °C

6. Nov/2021/Paper_12/No.19

The graph is the temperature–time graph for a sample of wax that is heated so that it melts.



The mass of the wax is 200 g.

Thermal energy is supplied to the wax at a constant rate of 12 000 J / minute.

What is the specific latent heat of fusion of the wax?

A 180 J / g **B** 240 J / g **C** 480 J / g **D** 600 J / g

7. Nov/2021/Paper_21/No.9

Liquid-in-glass thermometers use the expansion of a liquid to indicate the temperature.

(a) Fig. 9.1 shows the molecular structure of a solid and a gas.

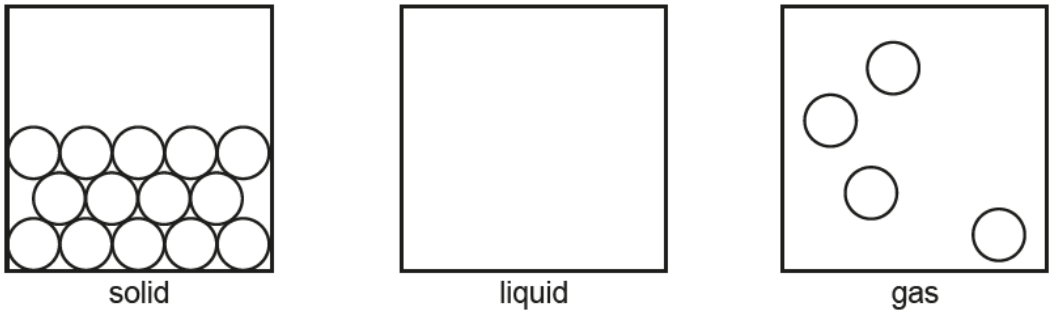


Fig. 9.1

(i) In the middle box of Fig. 9.1, sketch a diagram to show the molecular structure of a liquid. [2]

(ii) Explain why it is easier to compress a gas than to compress a solid.

.....

.....

..... [2]

(iii) The temperature of a liquid-in-glass thermometer increases.

State **two** ways in which the molecules of the liquid in the thermometer are affected.

1. .....

2. .....

[2]

(b) Fig. 9.2 shows the liquid-in-glass thermometer.

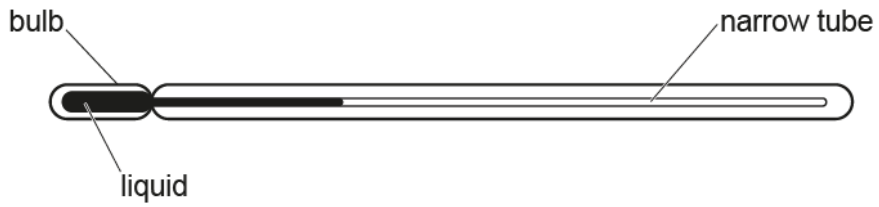


Fig. 9.2

There is no scale on the thermometer.

(i) State what is meant by the *ice point* and the *steam point*.

ice point .....

.....

steam point .....

.....

[2]

(ii) Describe how the *ice point* and the *steam point* are used on the thermometer.

.....

.....

.....

..... [2]

(c) Explain how the range of a liquid-in-glass thermometer is affected by:

(i) increasing the mass of liquid in the bulb

.....

.....

..... [2]

(ii) increasing the diameter of the narrow tube.

.....

.....

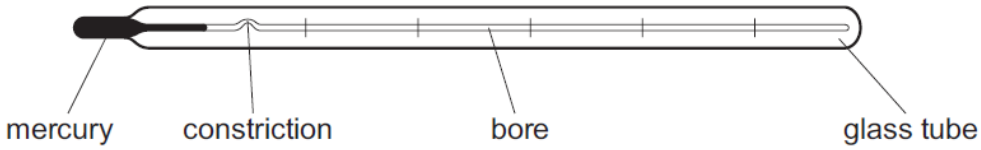
.....

..... [3]

[Total: 15]

8. June/2021/Paper_11/No.16

The diagram shows a clinical thermometer.



Which factor affects the sensitivity of the thermometer?

A the constriction

B the diameter of the bore

C the length of the glass tube

D the thickness of the glass tube

9. June/2021/Paper_11/No.17

Which row is correct for a thermocouple thermometer?

	measures very high temperatures	responds quickly to change in temperature
A	no	no
B	no	yes
C	yes	no
D	yes	yes

10. June/2021/Paper_11/No.18

What is the *heat capacity* of a body?

A the amount of thermal energy that the body can absorb without melting

B the amount of thermal energy required to raise the temperature of the body by 1.0 °C

C the amount of thermal energy required to raise the temperature of 1.0 kg of the body by 1.0 °C

D the amount of thermal energy required to raise the temperature of 1.0 m^3 of the body by 1.0 °C

11. June/2021/Paper_11/No.19

Which statement about water is correct?

A At the boiling point, water vapour molecules have the same kinetic energy as liquid water molecules.

B Evaporation occurs only at the boiling point.

C Water molecules become heavier when water freezes.

D Water molecules lose all of their kinetic energy when water freezes.

12. June/2021/Paper_12/No.19

The list shows four physical properties.

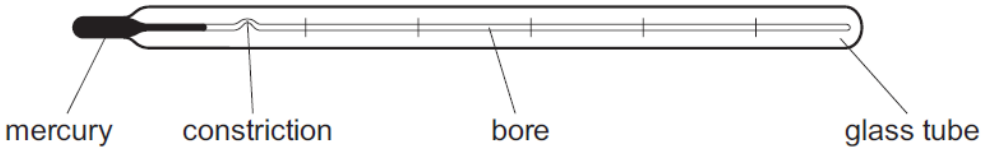
mass resistance voltage volume

How many of these properties can be used to measure temperature?

A 1 **B** 2 **C** 3 **D** 4

13. June/2021/Paper_12/No.20

The diagram shows a clinical thermometer.



Which factor affects the sensitivity of the thermometer?

A the constriction

B the diameter of the bore

C the length of the glass tube

D the thickness of the glass tube

14. June/2021/Paper_12/No.21

Which statement about the thermal expansion of solids, liquids and gases is correct?

A Liquids do not expand.

B Liquids expand more than gases but less than solids.

C Liquids expand more than solids but less than gases.

D Liquids expand the same amount as solids but less than gases.

15. June/2021/Paper_21/No.3

A hot steel rod is cooled by plunging it into cold water, as shown in Fig. 3.1.

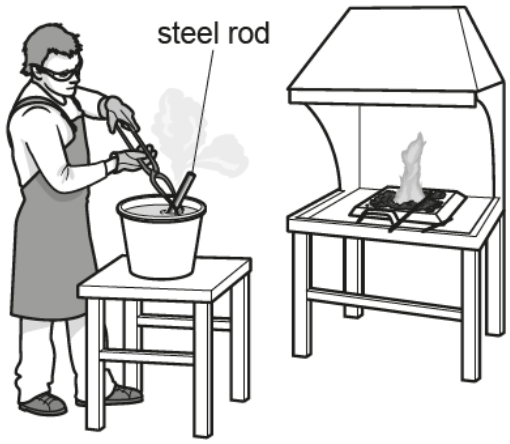


Fig. 3.1

(a) The steel rod has a mass of 2.0 kg and is initially at a temperature of 500 °C. It cools to 50 °C when placed in the water.

The specific heat capacity of steel is 460 J/(kg °C).

Calculate the thermal energy (heat) lost by the steel rod as it cools to 50 °C.

thermal energy = ... [3]

(b) A small mass of water boils when the rod is placed in the water. The remaining water then cools to room temperature and some of it evaporates.

In both boiling and evaporation, water molecules escape into the air.

(i) State **one** way in which boiling is *different* from evaporation.

.....

.....

..... [1]

(ii) The rate of evaporation decreases as the water cools.

Explain why this happens, using ideas about molecules.

.....

.....

..... [2]

[Total: 6]

16. June/2021/Paper_22/No.9c

(c) A student estimates the thermal energy produced in the battery when the mobile phone is used and uses this value to estimate the efficiency of the battery.

He measures a temperature rise of 5.0 °C within the battery in a period of time when the useful energy output from the battery is 5200 J.

The mass of the battery is 110 g and its specific heat capacity is 830 J / (kg °C).

(i) Calculate the thermal energy (heat) needed to raise the temperature of the battery by 5.0 °C.

thermal energy = ... [3]

(ii) State what is meant by *efficiency*.

.....

..... [2]

(iii) Calculate the efficiency of the battery.

efficiency = ... [2]

(iv) Suggest and explain **one** reason why the value for the efficiency calculated in **(iii)** is larger than the actual efficiency of the battery.

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.....

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..... [2]