Matter – 2021/20 GCSE Gateway Physics A

1. Nov/2021/Paper_J249/01/No.5

Which of the following is an example of a chemical change?

A Burning

B Evaporating

C Melting

D Sublimating

Your answer ☐ **[1]**

2. Nov/2021/Paper_J249/01/No.7

Which statement explains why the atomic model has changed over time?

A Models can explain different situations.

B Models can only be used for a limited time period.

C New information is discovered.

D Scientists are paid to keep changing models.

Your answer ☐ **[1]**

3. Nov/2021/Paper_J249/01/No.13

A teacher evaporates 50 g of water. They collect all of the steam and condense it back into water.

Which statement is true?

A The mass of the steam produced is less than 50 g.

B The mass of the steam produced is more than 50 g.

C The mass of the water at the end is 50 g.

D The mass of the water at the end is less than 50 g.

Your answer ☐ **[1]**

4. Nov/2021/Paper_J249/01/No.15

The specific latent heat of fusion for lead is 24 500 J / kg.

Calculate the thermal energy required for 0.2 kg of lead to melt.

Use an equation from the data sheet to help you.

A 2450 J

B 4900 J

C 12 250 J

D 122 500 J

Your answer ☐ **[1]**

5. Nov/2021/Paper_J249/01/No.18

This question is about gas pressure.

(a) Complete each sentence to explain how temperature affects the pressure of a gas.

You can use each word once, more than once, or not at all.

area **distance** **energy** **pressure** **speed**

When the temperature of a gas increases, the particles have a greater average

..... and a greater average ..... .

The particles now collide more often with the sides of the container. More frequent collisions over a fixed area produce a greater ..... . **[3]**

(b) A student investigates how pressure and volume are linked for a gas at a fixed temperature.

Their results are shown in **Table 18.1**.

Pressure (kPa)	Volume (cm^3)
200	50
250	40
400	25
1000	10

Table 18.1

The student suggests that **pressure × volume = constant**

Use the data in **Table 18.1** to work out if the student is correct.

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

(c) Explain why atmospheric pressure **decreases** with height above the surface of the Earth.

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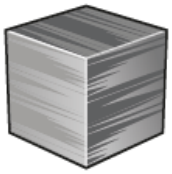
..... **[1]**

6. Nov/2021/Paper_J249/01/No.20

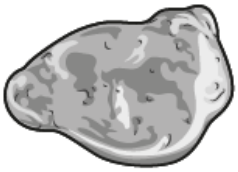
A group of students want to determine the density of two small objects, **A** and **B**.

A is a regular cube made of iron and **B** is an irregular-shaped object made of copper.

A



B



Describe the methods that the students would use to determine the density of iron and copper.

In your answer include:

- Equipment and equations that they would use.
- How they would make sure that their results are accurate and precise.

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..... **[6]**

7. Nov/2021/Paper_J249/02/No.11

A student calculates the change in the thermal energy of a 1 kg metal block.

The student heats the block and measures the change in temperature.

What other quantity is needed?

A Density of the metal

B Resistance of the metal block

C Specific heat capacity of the metal

D Volume of the metal block

Your answer ☐ **[1]**

8. Nov/2020/Paper_J249/01/No.1

What is the typical size for a small molecule?

A 0.1 cm

B 0.1 km

C 0.1 m

D 0.1 nm

Your answer ☐ **[1]**

9. Nov/2020/Paper_J249/01/No.15

Energy is needed to change ice into water.

Calculate the energy needed to change 5 kg of ice into water.

Use an equation from the data sheet to help you.

Specific latent heat of melting = 3.34×10^5 J/kg.

A 16.7 J

B 1670 J

C 1670000 J

D 1670000000 J

Your answer ☐ **[1]**

10. Nov/2020/Paper_J249/01/No.16

(a) Complete the sentences about an atom.

Use words from the list.

You may use each word once, more than once, or not at all.

Atom	**Electrons**	**Negatively**	**Neutrons**
Nucleus	**Orbits**	**Positively**	**Protons**

An atom has a ..... charged nucleus surrounded by .....

charged electrons.

The nucleus contains protons and ..... .

Almost all of the mass of an atom is in the ..... .

[4]

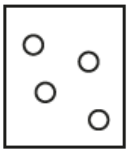
(b) **(i)** A swimming pool contains 9970 kg of water in 10 m^3.

Calculate the density of water.

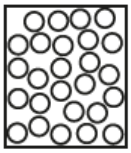
Use the equation: density = mass ÷ volume

Density = ... kg/m^3 **[2]**

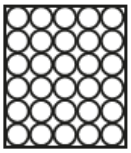
(ii) The diagrams, **A**, **B** and **C**, show the particles in three states of matter.



A



B



C

Write the letters in the boxes to give the correct order of density, from **most** to **least dense**.

Most dense ⟶ **Least dense**

☐ ☐ ☐

[1]

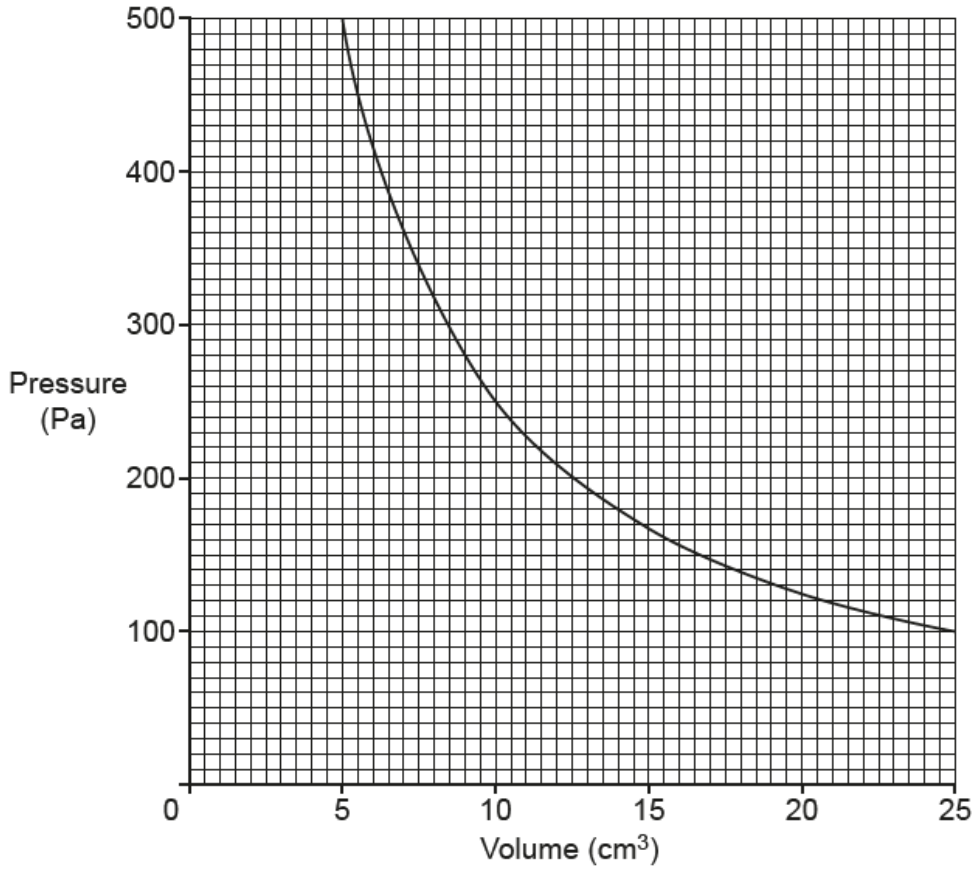
(iii) Explain why you chose the order in **(b)(ii)**.

.....

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

11. Nov/2020/Paper_J249/01/No.18

A student investigates the link between the volume and pressure of a gas. The student uses a fixed mass of gas in a closed container. The student plots a graph of the results.



(a) The student thinks that pressure multiplied by volume is always equal to the same number.

Explain why the student is correct.

Use data from the graph to support your answer.

.....

.....

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

(b) Complete the sentences to explain how volume and pressure are related.

Use words from the list.

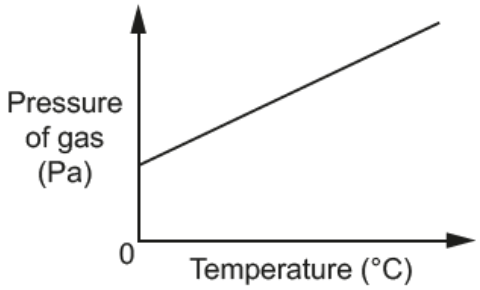
You can use each word once, more than once, or not at all.

doubled **halved** **the same**

If the volume of a gas is halved, the number of collisions per second between the gas particles and the container is ..... .

The pressure is ..... . **[2]**

(c) The student then investigates how temperature and pressure of a gas are linked. The student measures the pressure of a gas as its temperature increases. The results are plotted on a graph.



Explain how temperature and pressure are linked.

Use the graph to support your answer.

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

12. Nov/2021/Paper_J249/03/No.18

A student heats 0.20 kg of water in a beaker until it evaporates into steam. The starting temperature of the water is 20 °C.

(a) (i) The specific heat capacity of water is 4200 J/kg °C.

Calculate the energy needed to raise the temperature of the water to 100 °C.

Use an equation from the data sheet to help you.

Energy needed = ... J **[2]**

(ii) The specific latent heat of vaporisation of water is 2 260 000 J/kg.

Calculate the energy needed to turn all the water at 100 °C into steam.

Use an equation from the data sheet to help you.

Energy needed = ... J **[2]**

(iii) Use your answers from **(a)(i)** and **(a)(ii)** to calculate the **total** energy needed to turn 0.20 kg of water at 20 °C into steam at 100 °C.

Write your answer in **standard form** and to **2 significant figures**.

Total energy needed = ... J **[3]**

(b) (i) Suggest **two** reasons why the actual energy needed to turn the water into steam was **more** than the value calculated in **(a)(iii)**.

Reason 1 .....

.....

Reason 2 .....

.....

[2]

(ii) Another student says, 'You should repeat your experiment three times and calculate a mean.'

Suggest **one** advantage of repeating an experiment.

.....

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

13. Nov/2021/Paper_J249/03/No.23

(a) The air in a car tyre has a pressure of 200 kPa.

A driver notices that after a long journey the pressure in the tyre has increased. They think this is because the temperature of the tyre has increased.

Explain, in terms of molecules, why the pressure in the tyre has increased.

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

(b) A student writes down a simple model of the Earth's atmosphere.

Simple model of the Earth's atmosphere

- The atmosphere is a single layer of gas that covers the Earth.
- The density of the air is uniform.
- The thickness of the atmosphere is large compared to the diameter of the Earth.

The student has made **one** mistake in their work.

Identify the wrong word the student used and write the correct word needed to replace it.

Wrong word: .....

Correct word: .....

[2]

14. Nov/2020/Paper_J249/03/No.10

A student investigates what happens when she heats a beaker of water.

	The temperature increases	The state changes	The energy stored in the water changes
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✗
D	✗	✗	✓

Which row in the table describes what **could** happen when the water is heated?

Your answer ☐ **[1]**

15. Nov/2020/Paper_J249/03/No.14

What is the change in pressure when a diver moves from a depth of 3.0 m to a depth of 8.0 m?

Assume gravitational field strength on Earth = 10 N/kg and water density = 1000 kg/m^3.

Use an equation from the data sheet to help you.

A 30 000 Pa

B 50 000 Pa

C 80 000 Pa

D 110 000 Pa

Your answer ☐ **[1]**

16. Nov/2020/Paper_J249/03/No.20

(a) A student uses a ruler to determine the volume of a cube, **A**. The length of one side of the cube is 0.100 m.

(i) Calculate the volume of cube **A**.

Volume of cube **A** = ... m^3 **[2]**

(ii) Cube **B** has the same volume as cube **A**.

The mass of cube **B** is ten times greater than the mass of cube **A**.

Compare the density of cube **B** with cube **A**.

Use the equation for density to help your explanation.

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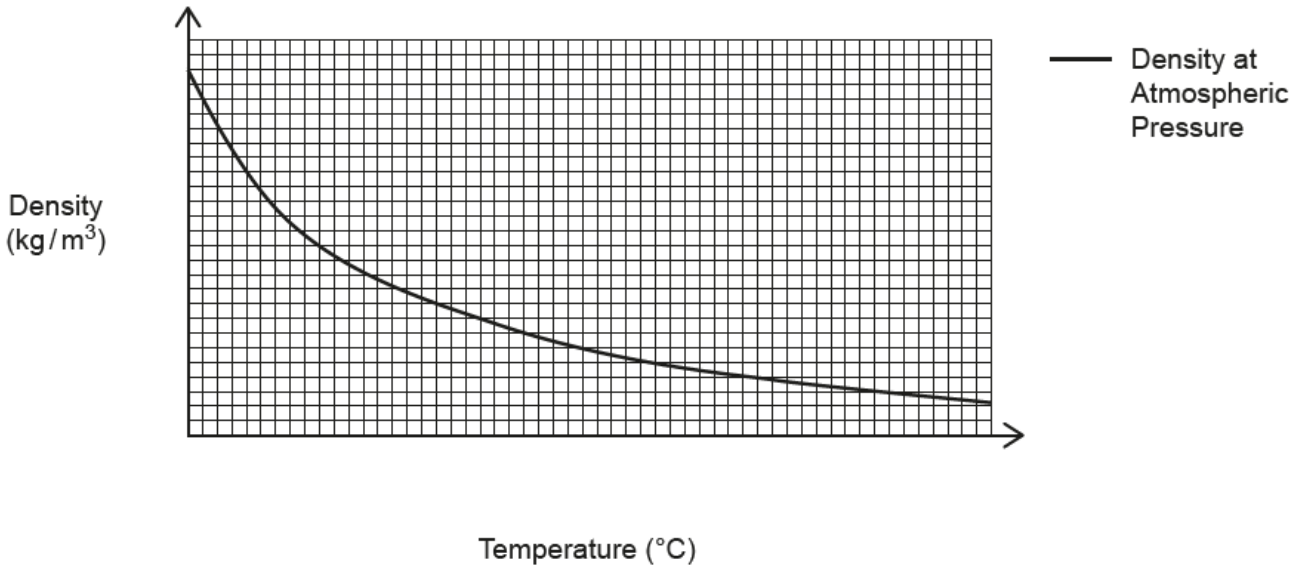
..... **[2]**

(b) A student researches how the density of air varies with the temperature of the air. Look at the graph of her findings.



Describe the relationship between the temperature and density of air shown in the graph.

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

(c) Give **one** reason why a solid is more dense than a gas.

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

(d) A boat can be made out of concrete.

Explain why a concrete boat floats but a lump of concrete sinks.

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

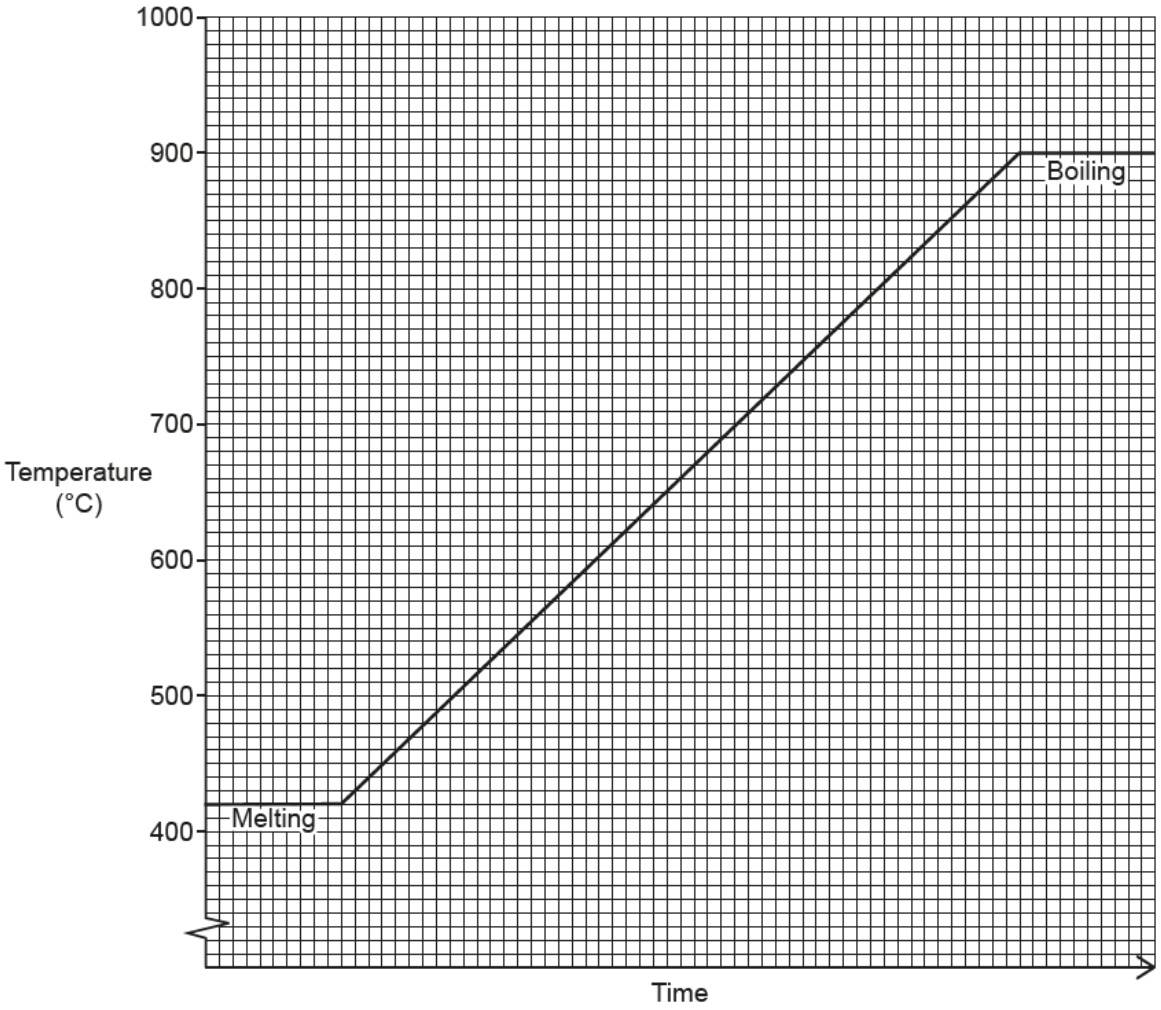
17. Nov/2020/Paper_J249/03/No.23

The table shows the specific heat capacities of different materials.

Material	Specific heat capacity (J/kg °C)
Copper	330
Brass	380
Zinc	385
Nickel	440
Concrete	880
Aluminium	913

A scientist heats an unknown substance from a solid to a liquid.

The graph shows how the temperature of the substance varies with time.


1000
900
800
700
600
500
400
Temperature
(°C)
Boiling
Melting
Time

The scientist has 2.5 kg of the substance and records that it takes 462 kJ of energy to increase it from the lowest to the highest temperature in the liquid state.

(a) Use the graph to calculate the specific heat capacity of the substance.

Suggest what material it could be from the table.

Specific heat capacity = ... J/kg °C

Material = ...

[5]

(b) Suggest **two** reasons why the scientist cannot be certain that the substance has been identified correctly.

1 .....

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2 .....

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[2]