01 For each of the following situations, choose the correct word from those given to identify the correct state of matter or change between types of matter.

E

solid	**liquid**	**gas**	**boiling**	**melting**
evaporating	**freezing**	**condensation**	**sublimation**	

Each word can be used, once, more than once, or not at all.

01.1 Water at 15 °C is a _____. **[1 mark]**

01.2 The change of state from a gas to a liquid is known as _____. **[1 mark]**

01.3 _____ is the change of state from a solid to a gas. **[1 mark]**

01.4 When ice melts is changes from a _____ to a _____. **[2 marks]**

01.5 Calculate the energy needed to heat 1.62 kg of water from 15 °C to 100 °C. The specific heat capacity of water is 4200 J/kg °C. **[4 marks]**

Use the equation:

Energy transferred = mass × specific heat capacity × temperature change

Give your answer in kJ.

_____

_____

_____

_____kJ

02 A Uranium atom can be represented by the following symbol.

$$^{235}_{92}\mathrm{U}$$

02.1 Complete the following sentence. **[2 marks]**

A uranium-235 nucleus has _____ protons and _____ neutrons.

02.2 Another uranium atom is represented by the following symbol

$$^{238}_{92}\mathrm{U}$$

This uranium atom has a different number of neutrons.
It is known as an _____. **[1 mark]**

02.3 Uranium-238 decays by releasing an alpha particle to form thorium.

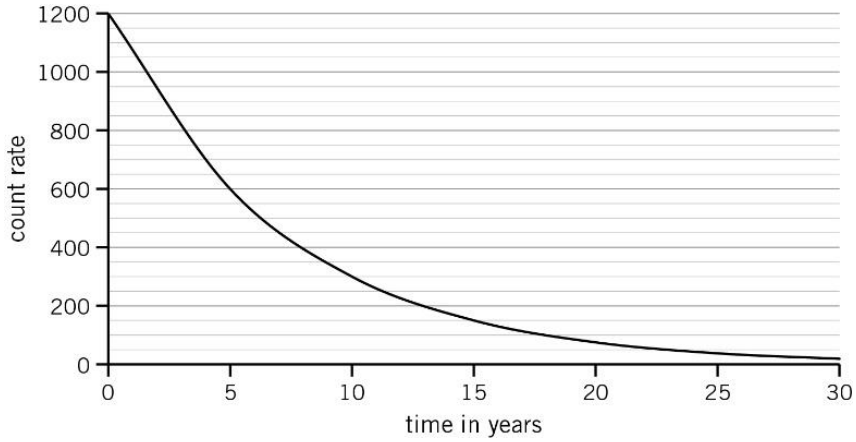
Describe the structure of an alpha particle. **[2 marks]**

_____

_____

02.4 **Figure 1** shows the radioactive decay of an isotope

Figure 1



Use **Figure 1** to calculate the half-life of the isotope. **[2 marks]**

_____

_____

03 A 0.5 kg ball is thrown upwards and reaches a maximum height of 5 m.

03.1 When the ball is thrown, it has maximum _____ energy. **[1 mark]**

Tick **one** box.

Gravitational potential ☐

Kinetic ☐

Thermal ☐

Chemical ☐

03.2 When it reaches its maximum height, it has maximum _____ energy. **[1 mark]**

Tick **one** box.

Gravitational potential ☐

Kinetic ☐

Thermal ☐

Chemical ☐

03.3 Calculate the maximum gravitational potential energy of the ball. **[4 marks]**

Give the unit.

_____

_____

_____

_____

03.4 Use your answer to **03.2** to calculate the maximum velocity of the ball when it returns to the hand of the person who threw it. **[4 marks]**

Use the equation

$$\text{Kinetic energy} = 0.5 \times \text{mass} \times \text{velocity}^2$$

Give the unit.

Maximum velocity =_____

Unit =_____

04 A circuit is connected using a battery, a lamp, an ammeter, and a voltmeter.

04.1 Draw a circuit diagram showing these connected in series. **[3 marks]**

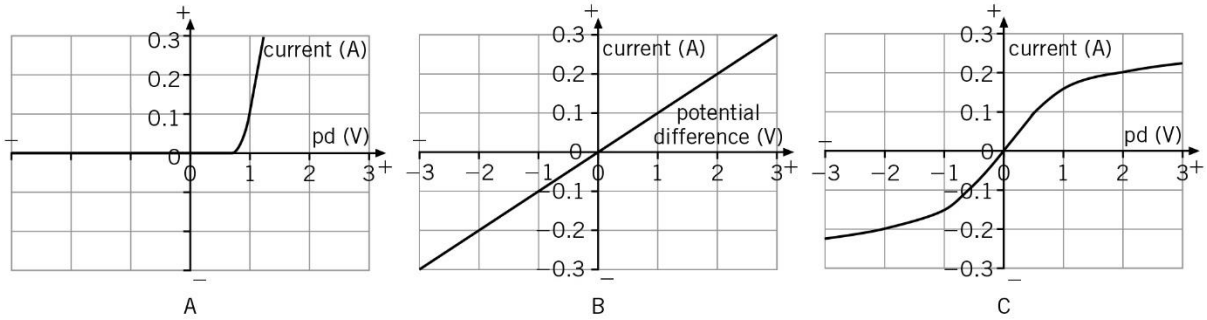
04.2 State what is meant by direct current. **[1 mark]**

_____

04.3 Which graph in **Figure 2** is a current–potential difference graph for the lamp? **[1 mark]**

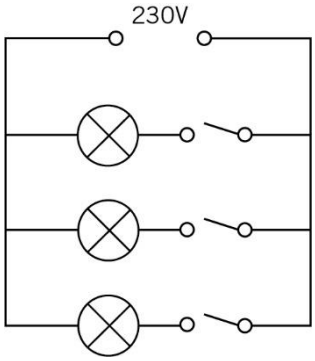
_____

Figure 2



04.4 The lamps in the circuit shown in **Figure 3** are connected in parallel.

Figure 3



State an advantage of using a parallel circuit in lighting. **[1 mark]**

_____

04.5 The circuit is connected to an alternating mains supply. Explain what is meant by an alternating current. You may draw a diagram to help with your answer. **[2 marks]**

_____

_____

_____

05 Gas is a non-renewable energy source.

05.1 Describe what is meant by a non-renewable energy source. **[1 mark]**

_____

05.2 State **one** other non-renewable energy sources **[1 mark]**

_____

_____

05.3 An electricity company is considering investing in renewable energy. Off-shore wind farms and hydroelectric power stations are two types that they are considering.

The wind farm would cost £25 million and could produce a maximum of 2 million kWh of electricity per day.

The hydroelectric power station would cost £100 million and could produce a maximum of 3 million kWh per day.

Compare the advantages and disadvantages of each type of electricity generation, and suggest which renewable source the company should invest in. **[6 marks]**

_____

_____

_____

_____

_____

_____

_____

06 Latent heat is energy that is released of absorbed when a substance changes state.

06.1 What is meant by specific latent heat of fusion? **[2 marks]**

_____

_____

06.2 Calculate the amount of energy required to melt 6 kg of ice at 0 °C. The specific latent heat of fusion of ice = 3.4×10^5 J/kg. Give your answer to 2 significant figures. **[3 marks]**

Use the equation

Energy for a change of state = mass × specific latent heat

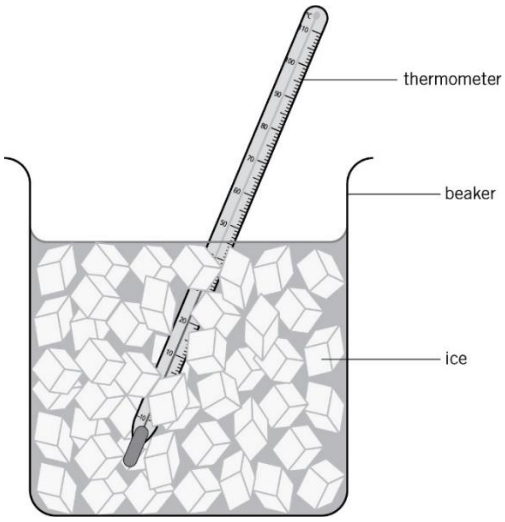
_____

_____

06.3 If salt is added to ice, the melting point of the ice changes. A student investigated how the melting point of ice varies with the mass of salt added.

Figure 4 shows the equipment that she used.

Figure 4



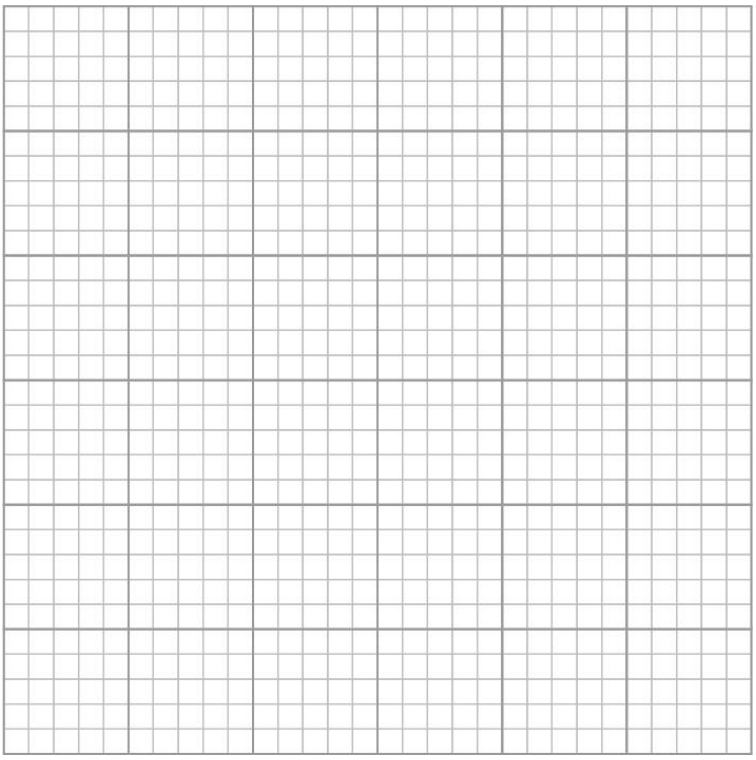
The student added salt to the crushed ice and measured the temperature at which the ice melted.

State **one** variable that the student should control. **[1 mark]**

The table below shows the data that the student obtained.

Mass of salt added in g	0	5	10	15	20	25
Melting point of ice in °C	0	−11	−8	−12	−16	−20

06.4 On the graph paper below, draw a graph to show this data. **[4 marks]**



06.5 Circle the anomalous point. **[1 mark]**

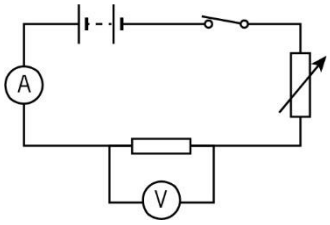
06.6 Describe the pattern shown by the data. **[2 marks]**

_____

_____

07 **Figure 5** shows a circuit that was set up by a student.

Figure 5



The student uses the circuit to test the following hypothesis:

The current through a resistor is directly proportional to the potential difference across the resistor

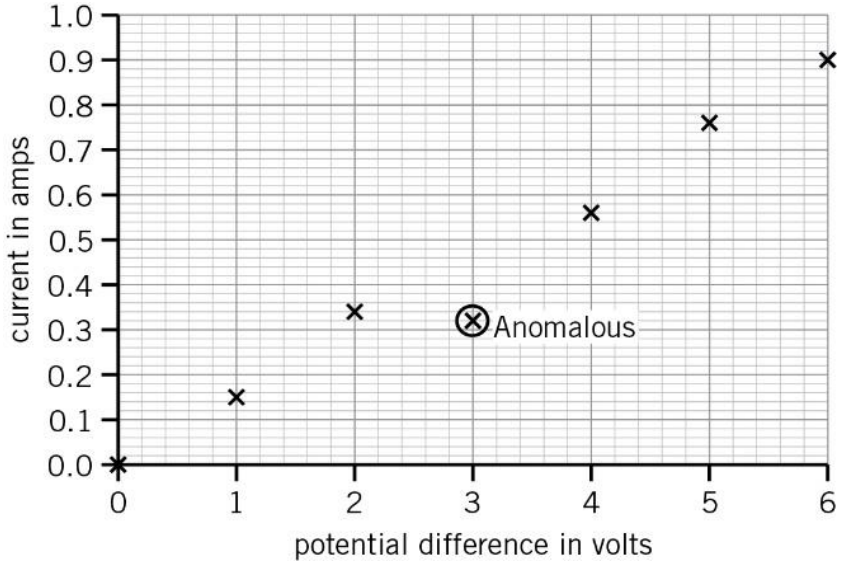
07.1 If the hypothesis is correct, predict will happen to the current through the resistor when the potential difference across the resistor is doubled? **[1 mark]**

_____

07.2 Name the component in the circuit that is used to change the potential difference across the resistor. **[1 mark]**

The student used the data obtained to plot the points for a graph of current against potential difference as shown in **Figure 6**.

Figure 6



07.3 Draw a line of best fit for these points. **[1 mark]**

07.4 One of the points has been identified as being anomalous. What is the most likely cause for this anomalous point? **[1 mark]**

_____

07.5 Does the data the student obtained support the hypothesis? Give a reason for your answer. **[1 mark]**

_____

07.6 In a similar circuit, the output voltage of the battery is 6 V. The resistance of the components in the circuit is 2 Ω.

Calculate the current in the circuit and give the correct unit. **[4 marks]**

_____

_____

_____

_____

08 The following are parts of an atom:

proton **electron** **neutron** **nucleus**

08.1 Choose from the list the one that: **[3 mark]**

Has no electrical charge _____

Contains two of the other particles _____

Has very little (negligible) mass _____

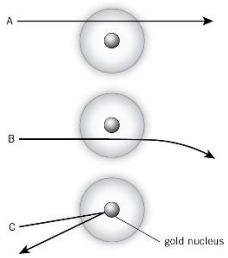
08.2 Explain why an atom has no overall electrical charge. **[2 marks]**

_____

_____

08.3 In the 20th century, scientists investigated the paths taken by positively charged alpha particles directed into and out of a very thin piece of gold foil. **Figure 7** shows the paths of three alpha particles.

Figure 7



Explain the different paths A, B and C of the alpha particles. **[3 marks]**

_____

_____

_____

09 A student is investigating energy-saving light bulbs.

09.1 A 60 W light bulb uses 1200 J of electrical energy in a certain period of time.

Calculate the amount of time the light bulb is turned on for. **[4 marks]**

_____

_____

_____

_____

09.2 In that time, it produces 900 J of light energy. The rest of the energy is wasted.

Calculate the energy wasted by the light bulb in this period of time. **[1 mark]**

_____

09.3 What happens to the energy wasted by the light bulb? **[1 mark]**

_____

09.4 Calculate the efficiency of this light bulb. **[2 marks]**

_____

10 A student is investigating what happens when a polythene rod is rubbed with a duster.

The student holds the rod above some small pieces of dry paper.

10.1 What does the student observe when the rod is held above the pieces of paper? Explain why this happens. **[2 marks]**

_____

_____

10.2 If you rub your hands all over the rod, what will now be observed and why? **[2 marks]**

_____

_____

10.3 Static electricity can be used to help paint cars.

Use the following words complete the sentences. **[3 marks]**

You do **not** have to use all of the words.

attract **opposite** **repel** **same**

All the paint droplets have the same type of charge. This makes the paint droplets _____ each other and spread out.

The car panel and the paint droplets have the _____ type of charge.

This causes the car panel to _____ the paint droplets. The car panel is then covered by an even layer of paint.

11 A teacher has two sources of radiation that look identical. One source emits only alpha radiation, the other only emits beta radiation.

11.1 Describe a way to find out which source emits the alpha radiation. Name the detector you would use. You may wish to draw a diagram to help with your answer. **[4 marks]**

_____

_____

_____

_____

Before conducting the experiment, the teacher took some readings of background radiation. Background radiation can come from natural or man-made sources.

11.2 Name **one** source of background radiation. **[1 mark]**

_____

The teacher took the readings three times and obtained the following results

Reading
9
11
7

11.3 Why are the readings different? **[1 mark]**

_____

11.4 Calculate the average reading **[1 mark]**

_____

11.5 Some scientists claim that people living in areas of high natural background radiation are more likely to develop cancer than people living in similar areas with lower background radiation.

The evidence that these scientists found does not definitely mean that the level of background radiation determines whether a person will develop cancer. Suggest a reason why. **[1 mark]**

_____

12 A student investigated the cooling of stearic acid over 5 minutes.

The student removed the thermometer from the liquid each time they took a reading.

12.1 What type of error would this introduce? **[1 mark]**

Tick **one** box.

Systematic error ☐

Random error ☐

Zero error ☐

12.2 Name **one** safety precaution the student should follow **[1 mark]**

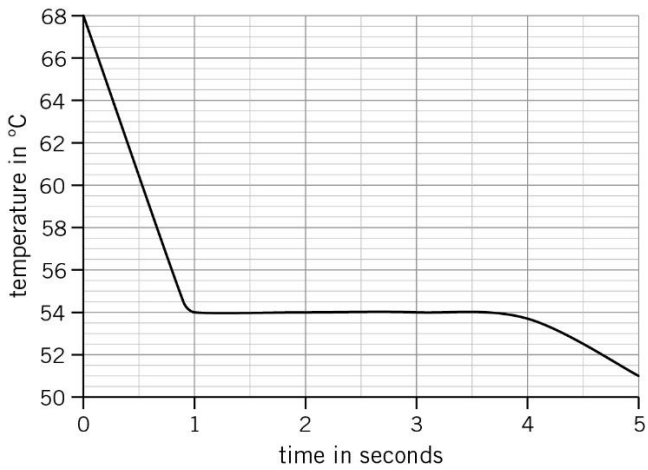
_____

12.3 Suggest a suitable way to improve the accuracy of this experiment. **[1 mark]**

_____

The student plotted their results on the graph shown in **Figure 8**.

Figure 8



12.4 What was the decrease in temperature between 0 and 1 minute? **[1 mark]**

_____

12.5 Use the graph to determine the time taken for the stearic acid to change from a liquid to a solid. **[1 mark]**

_____