T14 Particle Model MIXED

Section A

↓ *Pick one answer for each question*

1) Which word describes the movement of particles in a solid?
- ☐ **A:** sliding
- ☐ **B:** vibrating
- ☐ **C:** moving freely
- ☐ **D:** stationary

2) What is 'absolute zero' in degrees centigrade?
- ☐ **A:** -273
- ☐ **B:** -293
- ☐ **C:** 0
- ☐ **D:** -100

3) How does the mass of copper change when it melts?
- ☐ **A:** increases
- ☐ **B:** decreases
- ☐ **C:** stays the same
- ☐ **D:** goes to zero

4) Which value would be needed to calculate the energy required to boil a pot of water?
- ☐ **A:** change in temperature
- ☐ **B:** specific heat capacity
- ☐ **C:** latent heat of vaporisation
- ☐ **D:** latent head of fusion

5) Which of these equations contains specific heat capacity?
- ☐ **A:** $Q = m \times L$
- ☐ **B:** $y = mx + c$
- ☐ **C:** $KE = ½ \times m \times v^2$
- ☐ **D:** $\Delta Q = m \times c \times \Delta\theta$

6) If the temperature of a fixed volume of gas, measured in kelvin (K), doubles then what happens to the gas pressure?
- ☐ **A:** doubles
- ☐ **B:** halves
- ☐ **C:** stays the same
- ☐ **D:** quadruples

↓ *Add the words in the list to the summary of how a **simple kinetic theory model** explains changes of state*

WORD LIST
temperature ; solid ; force of attraction ; energy; liquid; melting point; gas; boiling point

The ..... of a substance is a measure of the average kinetic energy of the particles inside the substance.

If the temperature is low enough, any substance will be in a ..... state.

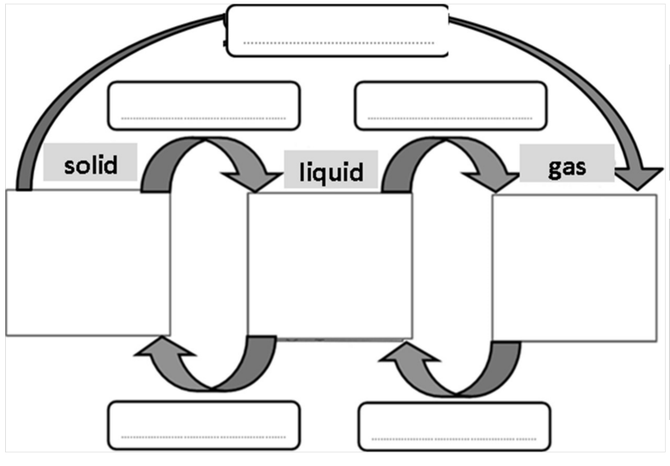
This is because the .... between the particles is greater than their movement energy and so the particles stick close together and are all touching.

When the substance is heated up ..... is taken in from the surroundings and stored in the substance. Its temperature increases.

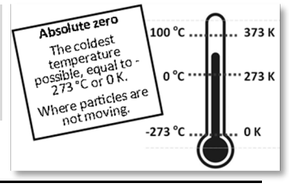
If enough extra energy is stored, the force of attraction between **some** of the particles is overcome and the substance becomes ..... The temperature that this happens at is called the ....

If more energy is stored, the force of attraction between **all** particles is overcome and the substance becomes a ..... The temperature that this happens at is called the ....*

*some substances skip being a liquid and go straight to being a gas.



← *draw particle diagrams and label the **state changes***

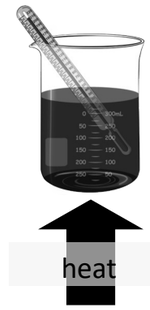


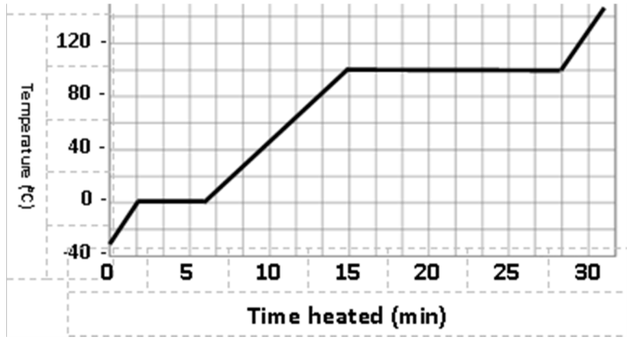
*convert the temperatures between **Kelvin and degrees centigrade** →*

°C	K
0	
	0
	293
-25	

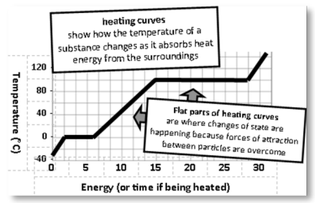
Section B

*Add labels from the word list to the **heating curve** and answer the questions after↓*





WORD LIST
boiling; gas; melting; solid; liquid



State the melting point of the substance ..... °C

State the boiling point of the substance ..... °C

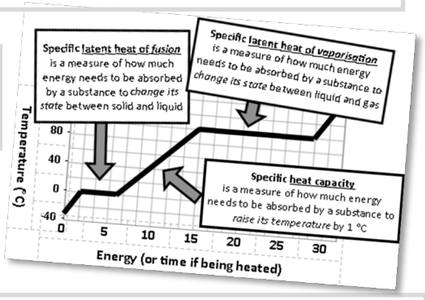
Suggest a temperature where the substance is liquid ..... °C

↓ *The raw results of an experiment **investigating the specific heat capacity of a liquid** are shown in the table below. Fill in the blanks and calculate the specific heat capacity.*

Mass of empty polystyrene cup (g)	0.01
Mass of cup and liquid (g)	0.16
Mass of liquid (g)	
Mass of liquid (**kg**)	
Initial temperature (°C)	19.4
final temperature (°C)	24.6
change in temperature (°C)	
Energy transferred (J)	3.3
Specific heat capacity (J/kg°C)	

converting g to kg
÷ 1000

change in any measurement
final value - initial value



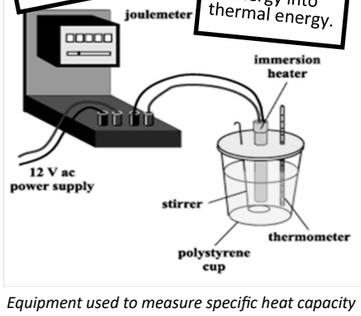
Use this equation to calculate specific heat capacity

change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta\theta$

↓ *Draw lines to match the steps in the method to the reasons behind them*

Joulemeters
Record how much energy is transferred through an electrical circuit.

Immersion heaters
Convert electrical energy into thermal energy.



Equipment used to measure specific heat capacity

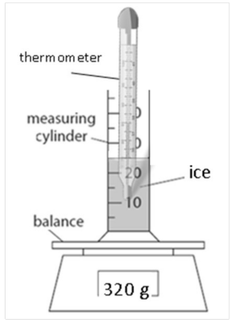
Liquid is stirred frequently.	Insulating material reduces energy the dissipates to the surroundings.
A lid is placed on the cup.	Ensures the temperature being measured is of the liquid not the heater.
Polystyrene cup used (instead of glass or metal).	Ensures thermal energy added is spread evenly.
There is a gap between the thermometer and the heater.	Stops dissipation of energy to the surroundings by convection.

combined sciences text book pages 413-425

Link to BBC Bitesize

Section C

↓ *Answer the questions about the **melting ice practical***



Equipment used to produce a temperature-time graph for melting ice

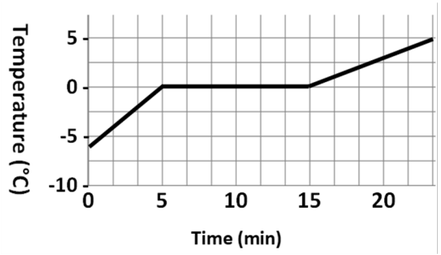
What was the melting point of the ice sample? ..... °C

At what time after the start had the sample fully melted? ..... minutes

For how many minute was the sample melting? ..... minutes

Describe how the reading on the balance would change as the ice melted:

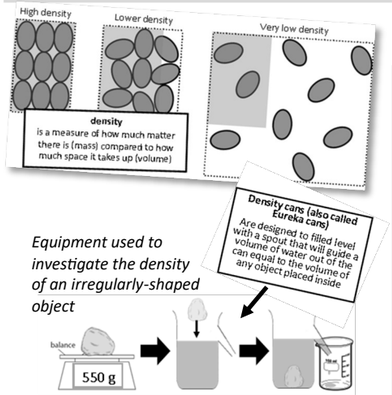
.....



temperature-time graph for a sample of melting ice

A student calculated that a 0.025 kg block of ice absorbed 8.35 kJ of energy during melting.
Use this equation to calculate the specific latent heat of fusion for ice.

thermal energy for a change of state = mass × specific latent heat	$Q = m \times L$



Equipment used to investigate the density of an irregularly-shaped object

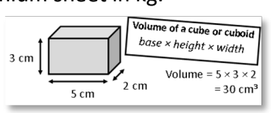
↓ *Answer the questions about **density***

A wine cork has a volume of 6.5 cm³ and its mass is 90 g.
Use this equation to calculate the **density**. Give your answers in g/cm³

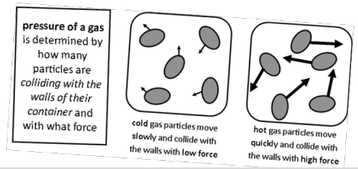
density = mass ÷ volume	$\rho = \frac{m}{V}$

A 550 g rock displaces 204 cm³ of water from a density can. What is the **density** of the rock in g/cm³?

An engineer designing a plane wing orders a sheet of aluminium that is 0.1 m deep, 0.8 m wide and 0.01 m tall. The density of aluminium is 2710 kg/m³.
Calculate the **mass** of the aluminium sheet in kg.



Section D



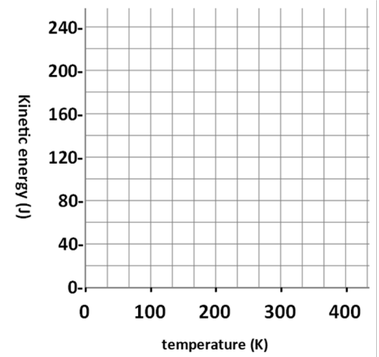
How much kinetic energy do any particles have at a temperature of 0 K (absolute zero)?

So what must the pressure of a gas in a fixed volume container be at 0 K?

So what happens to the pressure of a gas in a fixed volume container as its temperature increases?

Plot the data on the graph on the graph and add a line of best fit →

Temperature (K)	Kinetic energy (J)
100	60
200	120
300	180
400	240



Describe the relationship between temperature and the average kinetic energy of gas particles ↑

↓ *Give you answers to these questions to an **appropriate number of significant figures** and in **standard units.***

An Olympic silver medal weighs 210g and displaces 20 cm³ of water when submerged in a density can. Use this information to calculate the density of silver. Give your answer in g/cm³.	How much energy is needed to melt 10 kg of ice? Latent heat of vaporisation of water = 2.25×10^6 J/kg Latent heat of fusion of water = 3.34×10^5 J/kg	A 450 g aluminium door knocker cools down to -10 °C from 4 °C. How much energy was dissipated to the surroundings? (the specific heat capacity of aluminium is 900 J/kg°C)
The specific heat capacity of copper is 385 J/kg°C How much hotter would 2 kg of copper get if it absorbed 2310 J of energy from the surroundings?	A cube with sides of 3.0 cm is made out of stone that has a density of 2.5 g/cm³ What is the mass of the cube?	To make a gold ring a jewellery melts 4 g of solid gold. 252 J of thermal energy is absorbed by the gold while melting. What is the specific latent heat of fusion for gold? Give your answer in kJ/kg.

Answers						
	3 300 000	68	11	60	3	6000