Year 9

Physics booklet

Topic 3 - particles

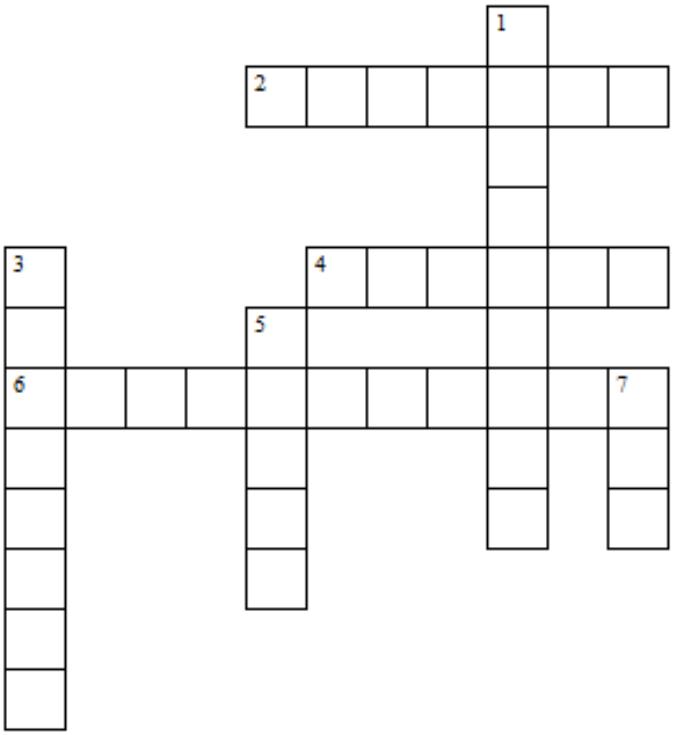
Name: _____

Particles

Give a definition for each of these key words:

Particle	
State	
State change	
Melt	
Freeze	
Evaporate	
Condense	
Sublimate	
Density	
Pressure	
Internal energy	
Specific heat capacity	
Latent heat	

States of Matter



ACROSS

2. The process that changes a solid to a liquid

4. Particles are able to flow over each other

6. The process that changes a liquid to a gas

DOWN

1. When gas or liquid particles become more spread out over time

3. The process that changes a liquid to a solid

5. Particles are in a fixed position and vibrate on the spot

7. Particles move randomly and are well spaced out

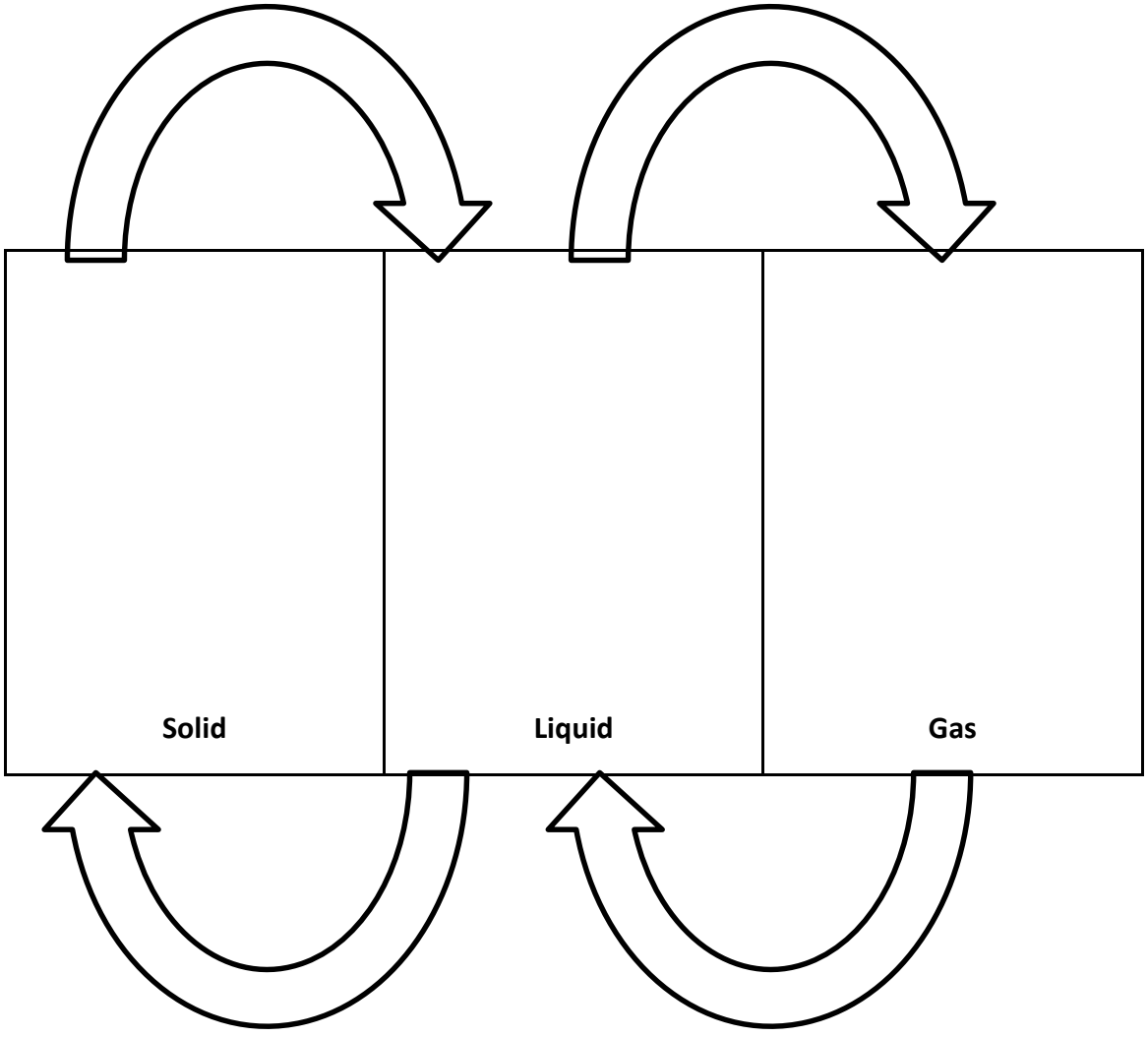
Changes of State

melting evaporation liquid particles gas bonds boiling

If you heat a solid it will eventually turn into a _____. This is called _____. If you carry on heating it, it will turn into a ___. This is called _____ or _____ .

A solid turns into a liquid when heated because the _____ have more energy. They begin to break their _____ and move around more. If you break all the bonds then the liquid turns into a gas.

Draw diagrams of the particle arrangements and label the changes of state below:



$\rho = m/V$

Density

What is the density of the following objects?

1. A solid block of wood with a mass of 132.5 kg and a volume of 0.25 m^3.

2. A liquid with a mass of 202.5 g and a volume of 15 cm^3.

3. A gas with a mass of 1.43g and a volume of 1000 cm^3.

What is the mass of the following objects?

4. A piece of magnesium ribbon (density 1.74 g/cm^3) with a volume of 0.1 cm^3.

5. A piece of zinc (density 7.14 g/cm^3) with a volume of 13 cm^3.

6. A Kevlar vest (density 1440 kg/m^3) with a volume of 0.005 m^3.

What is the volume of the following objects?

7. 2.7 kg of mercury (density 13.5 g/cm^3).

8. 3.0 kg of air (density 1.2 kg/m^3).

9. An ice cube (density 916.7 kg/m^3) with a mass of 10 g.

Pressure

$$P = F/A$$

A solid block, weighing 200 N, has the following dimensions:
0.1 m x 0.5 m x 0.3 m.

1. What is the maximum pressure it can exert on a surface?

2. What is the minimum pressure is can exert on a surface?

3. What would the pressure be if it was placed on the third side?

How much weight/force is required to give a pressure of 5000 N/m^2 in each of the following situations?

4. A child standing on a raft with an area of 0.05 m^2.

5. A table with four legs totalling an area of 0.01 m^2.

6. A quad bike with four wheels totalling an area of 0.36 m^2.

Pressure in Liquids

$$P = \rho gh$$

Calculate the pressure difference in the following situations.

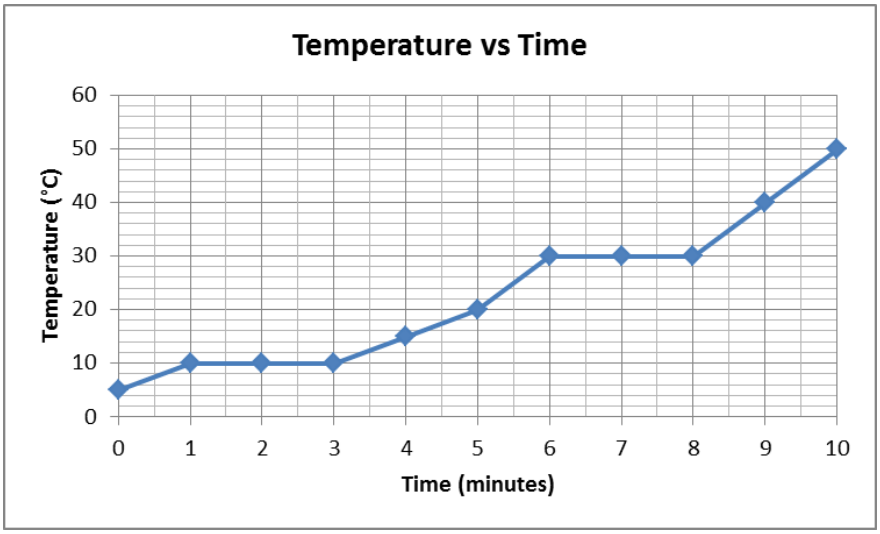
1. A fish descends 2 m in fresh water (density 1000 kg/m^3).

2. A fish descends 2 m in salt water (density 1027 kg/m^3).

3. A scuba diver that rises from 10 m below the surface to 2 m below the surface (in salt water).

Graphing Changes of State

1. Look at the graph below and then answer the questions.



a) Was the substance being heated or cooled?_____

b) How do you know this?_____

c) What was the **melting** temperature?_____

d) What was the temperature after 5 minutes?_____

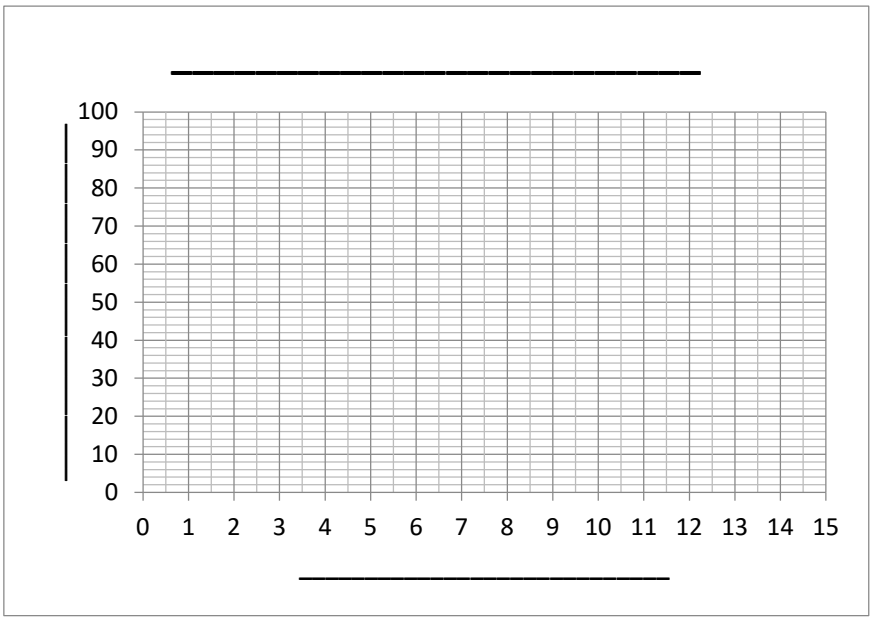
e) What was happening at 9.5 minutes? _____

f) What was the temperature at 9.5 minutes?_____

2. A student records the temperature of a substance for a period of several minutes. Her results are recorded in the table below.

Temperature Changes

Time (min)	Temperature (ºC)
0	91
1	85
2	76
3	71
4	64
5	55
6	48
7	42
8	42
9	43
10	42
11	34
12	27
13	22
14	13
15	7



Draw a LINE graph of her results with temperature on the vertical (side) axis and time on the horizontal axis. Make sure that you give the graph a title, your scales increase from zero and that the numbers are evenly spaced.

a) Was the substance being heated or cooled?_____

b) What was the **freezing** temperature?_____

c) What was the temperature after 5.5 minutes?_____

d) What was happening at 8.5 minutes? _____

e) What was the temperature at 8.5 minutes?_____

Specific heat capacity

The equation : $E = m \times C \times \Theta$

Where E= energy

m= mass (kg)

C= specific heat capacity (J/kg°C)

θ= change in temperature (°C)

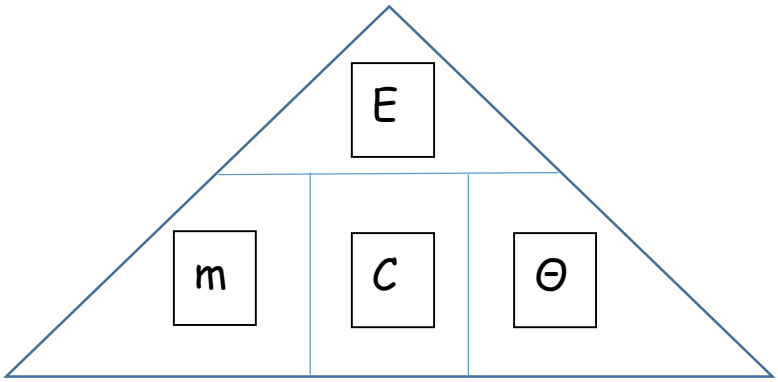


Table for different substances and their specific heat capacities

Substance	Specific heat capacity (J/kg°C)
Water	4200
Air	990
Copper	390
Iron	450
Concrete	3400
Cotton	1400

1. What are the units for specific heat capacity? _____
2. What is the unit for energy? _____
3. How much energy is needed to heat up 1kg of water by 15°C?

   _____

   _____

4. How much energy would be needed to raise the temperature of a 5kg block of concrete by 10°C?

   _____

   _____

5. Can you calculate the energy needed to increase the temperature of 100kg of iron by 40°C?

   _____

   _____

6. A 250g copper pipe is heated from 10°C to 31°C. What is the energy needed to heat the pipe?

   _____

   _____

7. Can you rearrange the equation to calculate the temperature difference?

   _____

   _____

8. What will be the temperature change if you used 1125J of energy to heat a block of iron weighing 0.5kg?

   _____

   _____