DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management
Educational Assessment Unit
Annual Examinations for Secondary Schools 2015

Track 2

FORM 3 PHYSICS TIME: 1 hr 30 min

Name: _____ **Class: _____**

INFORMATION FOR CANDIDATES

- **Where necessary take acceleration due to gravity 'g' to be 10 m/s^2.**
- **The use of a calculator is allowed.**
- **The number of marks for each question is given in brackets [ ] at the end of each question.**
- **You may find these equations useful:**

Density	$m = \rho V$		
Pressure	$P = \rho g h$	$F = P A$	
Forces	$W = m g$		
Moments	$Moment = F \times perpendicular\ distance$		
Energy	$P.E. = m g h$	$K.E. = \frac{1}{2}mv^2$	$Work\ Done = F s$
	$Work\ Done = Energy\ Converted$		$E = P t$
Heat	$\Delta Q = m c \Delta\theta$		

INSTRUCTIONS TO CANDIDATES

- **Use blue or black ink. Pencil should be used for diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before writing your answer.**
- **Answer ALL questions.**
- **All working must be shown.**

This document consists of 12 printed pages.

For Examiner's Use Only		
Question	**Max**	**Mark**
1	**8**	
2	**8**	
3	**8**	
4	**8**	
5	**8**	
6	**15**	
7	**15**	
8	**15**	
Written	**85**	
Practical	**15**	
Total	**100**	

SECTION A
Each question carries 8 marks. This section carries 40 marks of the total marks for this paper.

1. Matthew and Elisa decide to find the density of seawater. They measured the mass of an empty measuring cylinder and then poured an amount of seawater in the measuring cylinder and measured the mass of the cylinder with water.

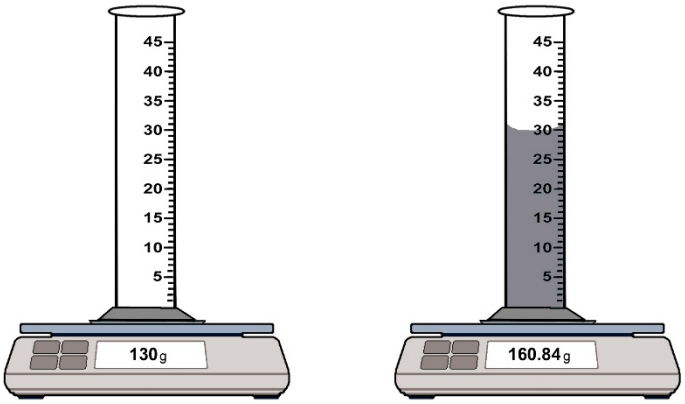


Figure 1

i) Calculate the mass of the seawater in the measuring cylinder.

_____**[2]**

ii) From the diagram above, record the volume of seawater in the measuring cylinder in cm^3.

_____**[1]**

iii) Calculate the density of seawater.

_____

_____**[2]**

iv) Mention a precaution Elisa and Matthew must take when reading the volume of the seawater to ensure an accurate result.

_____**[1]**

b) Elisa and Matthew find that an egg sinks in fresh water but floats in salty water. (The density of fresh water is 1 g/cm^3)

i) Explain why this happens.

_____

_____**[1]**

ii) Suggest a value for the average density of an egg.

_____

_____**[1]**

2. In an experiment to prove Hooke's Law, Maria and Gabriel found the following results:

Force (N)	0	1	2	3	4
Length of Spring (mm)	40	49	58		
Extension (mm)	0	9		27	36

a) Fill in the missing values. **[3]**

b) What is the original length of the spring? _____mm **[1]**

c) What can you say about the relationship between force and extension?

_____**[1]**

d) What type of graph will Maria and Gabriel obtain if they had to plot a graph of extension against force using the measurements in the table?

_____**[1]**

e) Gabriel decides to load the spring with much heavier weights. What do you think will happen? Explain.

_____

_____**[2]**

3. John uses a crowbar to lift up a piece of heavy furniture.

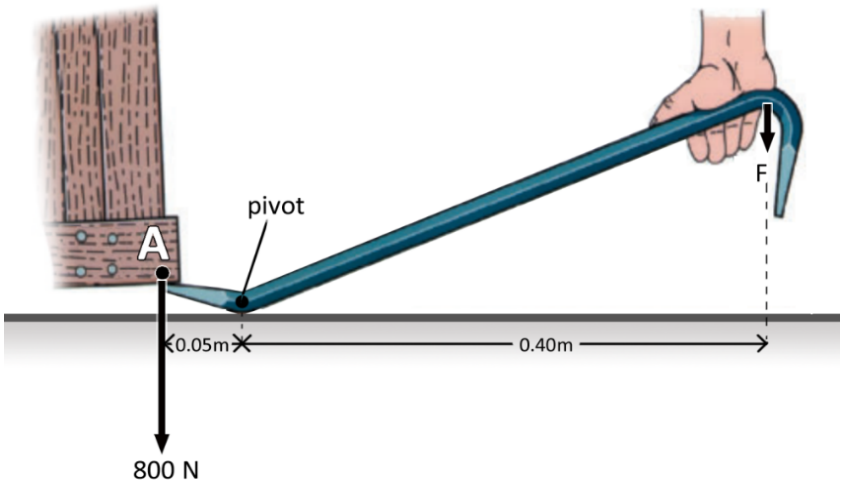


Figure 2

a) State the principle (law) of moments.

_____

_____

_____

_____

_____ **[1]**

b) Calculate the moment produced by the furniture if it makes a downward force of 800 N at Point A.

_____ **[2]**

c) What is the value of the moment produced by John assuming the system is in equilibrium?

_____ **[1]**

d) Underline the correct answer:
The direction of the moment produced by John is (clockwise, anticlockwise). **[1]**

e) The system is in equilibrium. Calculate the downward force F that John is exerting.

_____

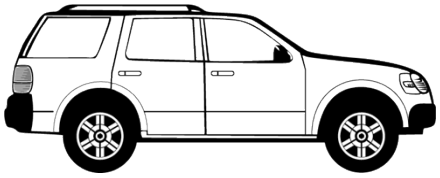
_____ **[2]**

f) What change should be done to the above setup so that the force that John makes to lift the furniture would be smaller?

_____ **[1]**

4.

a) Daniel and Julia pack their bags and go camping with their car. The mass of their car is 2700 kg, whilst Daniel, Julia and their bags have a mass of 160 kg. What is the total mass of the car, bags and passengers?



_____ **[1]**

b) Calculate the total weight of the car when Daniel, Julia and their bags are inside the car.

_____ **[2]**

c) The area of contact of one tyre with the ground is 0.04 m^2. What is the area of contact of the **four** tyres in m^2?

_____ **[1]**

d) Calculate the pressure that the car exerts on the ground when Daniel, Julia and their bags are inside the car.

_____

_____

_____ **[2]**

e) Daniel drives onto a sandy beach and the car is stuck in the sand. Julia explains to Daniel that if the pressure made by the tyres on the sand is reduced, they will be able to drive off. Suggest what they can do to decrease the pressure made by the tyres on the sand. Explain.

_____

_____ **[2]**

5. Maria decided to warm some tomato soup and measure the time taken for its temperature to rise. The graph below shows the temperature of the soup against the time taken to heat it from room temperature.

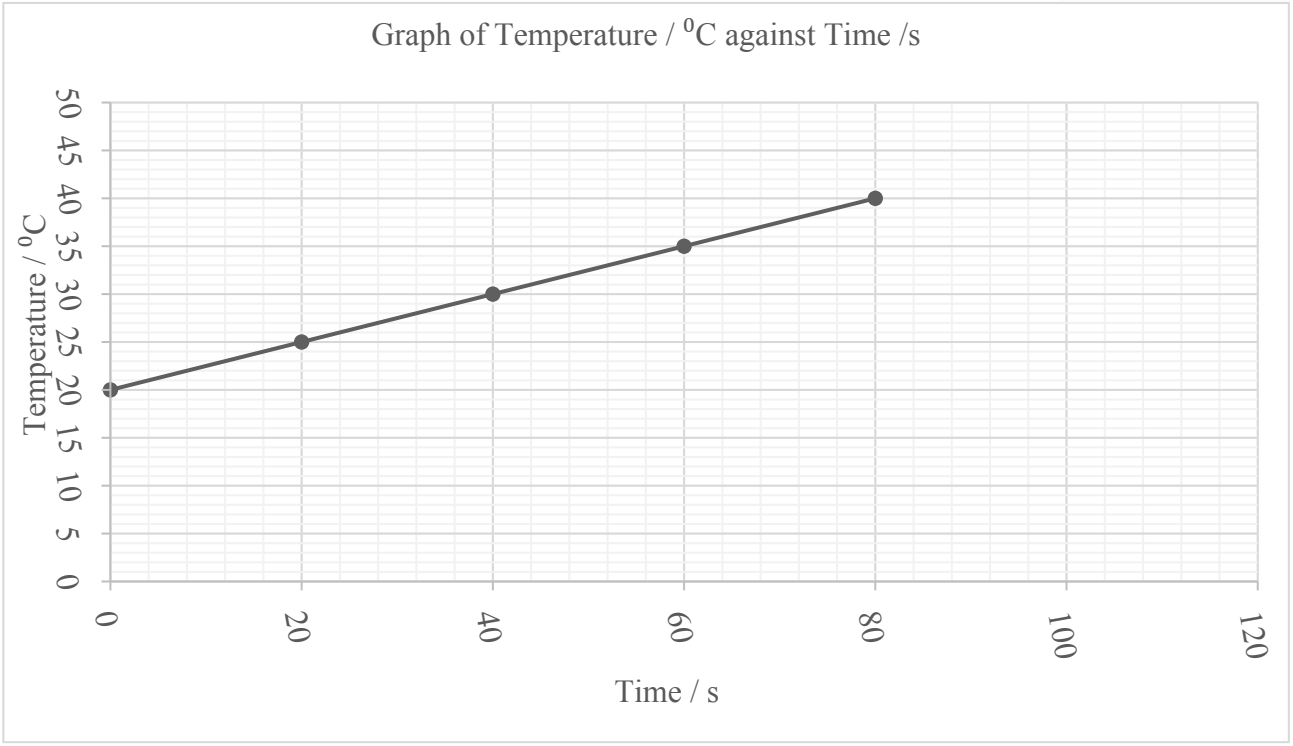


Figure 3

a) Name the instrument used to measure temperature. _____ **[1]**

b) From the graph, find the room temperature. _____$°C$ **[1]**

c) What is the temperature of the soup after 40 seconds? _____$°C$ **[1]**

d) Assuming the rate of temperature rise will remain the same, what is the total time needed to heat the soup from room temperature to 50$°C$? _____ s **[1]**

e) If the specific heat capacity of the tomato soup is 3980 $J/kg\,°C$ and the mass of the soup is 0.5 kg, find the heat energy needed to heat up the soup from 20$°C$ to 50$°C$.

_____

_____

_____**[2]**

f) A lid is placed over the saucepan. How will a lid help to cook the soup faster?

_____ **[1]**

g) Name a suitable material that could be used as a handle for the saucepan.

_____ **[1]**

SECTION B

Each question carries 15 marks. This section carries 45 marks of the total marks for this paper.

6. The diagram shows a model of a hydroelectric power station. Water from the reservoir flows down and turns the turbine which is connected to the generator. The generator changes this movement into electrical energy.

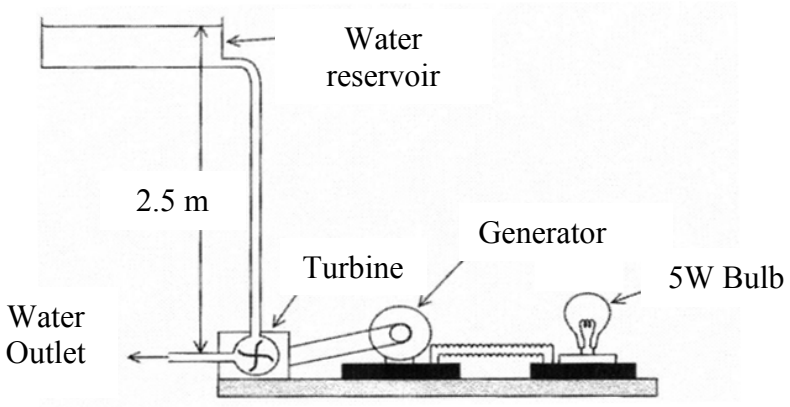
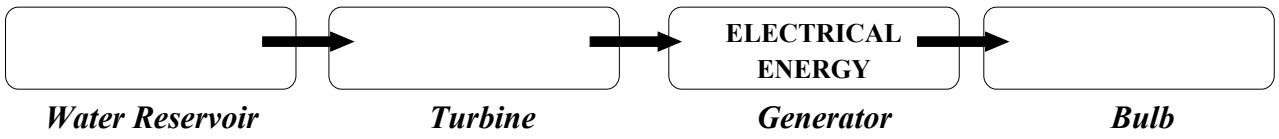


Figure 4

a) Fill in the following energy flow diagram. **[3]**



b) A 5 W bulb is connected as shown in the diagram.

i) How much electrical energy is supplied to the bulb in one second? _____ **[1]**

ii) Calculate the efficiency of the system if the power input is 10 W, given that the lamp is at its normal brightness (5 W).

_____

_____**[2]**

iii) The potential energy of the water in the reservoir is 100 J. Calculate the mass of water in the reservoir.

_____

_____**[2]**

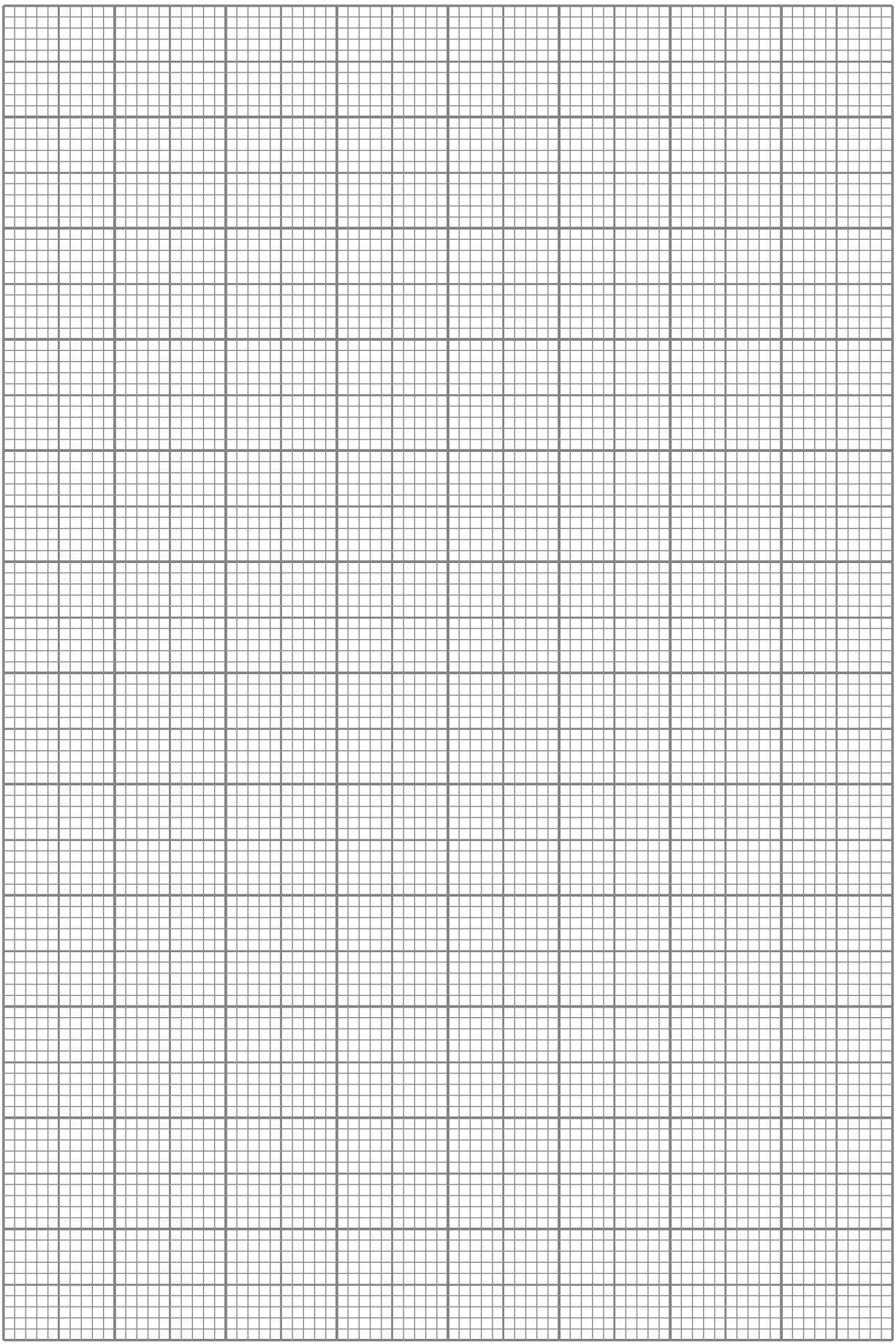
c) There is a relationship between the brightness of the bulb and the height of the water reservoir. In order to find the most appropriate height for the model, the following results were observed.

Potential Energy (J)	0	2.5	5.0	7.5	10.0	12.5	15.0
Height (m)	0	0.5	1.0	1.5	2.0	2.5	3.0

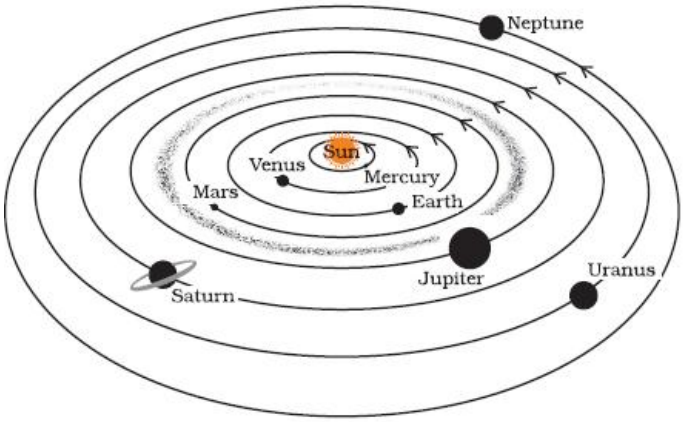
i) Plot a graph of Potential Energy (J) on the y-axis against Height (m) on the x-axis. **[5]**

ii) **<u>Underline</u>** the correct answer:

From the graph one can conclude that Potential Energy and Height are (*directly*, *inversely*) proportional to each other. This means that the higher the water reservoir the (*dimmer*, *brighter*) the bulb. **[2]**



7. The diagram shows our solar system.



a) Complete:

Our solar system can be found in one of the billions of galaxies that exist in our Universe. The name of our galaxy is _____. The planets in our solar system _____ around the Sun. There are _____ planets in our solar system. **[3]**

b) Give ONE difference between a planet and a star.

_____**[2]**

c) What force keeps the planets orbiting the Sun?

_____**[2]**

d) The table below shows data about some of the planets making up the solar system.

Planet	Mass ($\times 10^{24}$ kg)	Time to spin once on its own axis (hours)	Time to complete one orbit around the Sun (days)
Venus	4.87	5832	225
Earth	5.97	24	365
Saturn	568	11	10747
Uranus	86.8	17	30589
Neptune	102	16	59800

i) Which one of the above planets has the shortest year cycle?

_____**[2]**

ii) What information from the table above shows the length of a day on each planet? So, state which of the planets has the longest day.

_____**[2]**

iii) From the above table, which planet has the largest gravitational force?

_____**[2]**

iv) Name a dwarf planet in our solar system.

_____ **[2]**

8. Jake noticed that his hand feels hot when he holds it above a lit match, as shown in the diagram.

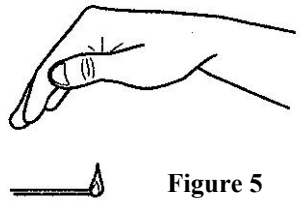


Figure 5

a) Name the process by which this takes place.

_____ **[1]**

b) The most effective way of saving money in a home is to have an efficient heating/cooling system. Double glazed windows are one example.

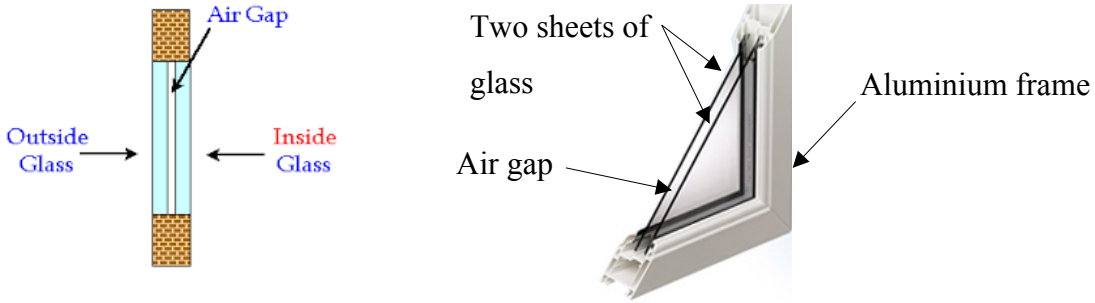


Figure 6

<u>Underline the correct answer:</u> Double glazed windows are more efficient than single glass windows because they *(increase, decrease)* heat transfer by conduction and convection. The air gap helps to reduce heat transfer by conduction because air is a good *(insulator, conductor)* of heat. **[2]**

c) The diagram below shows a test tube partly filled with water being heated by a Bunsen burner as shown.

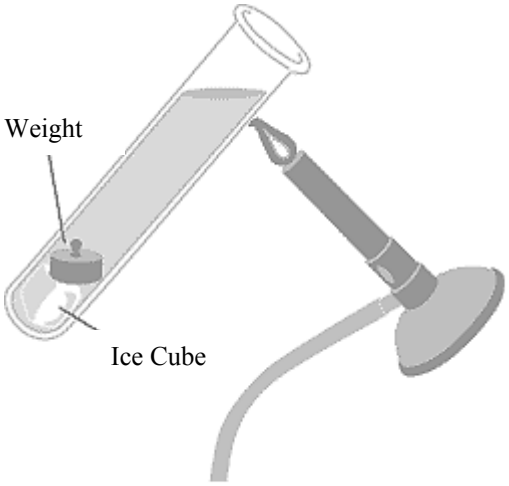


Figure 7

i) Explain the use of the weight in the diagram.

_____

_____ **[2]**

ii) Why does it take long for the ice cube to melt?

_____

_____ **[2]**

d) The diagram shows three rods, A, B and C. They are made of glass, iron and copper respectively.

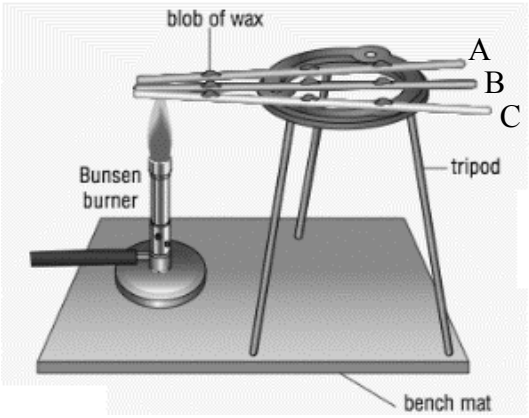


Figure 8

i) Name the process by which heat transfer occurs through the rods.

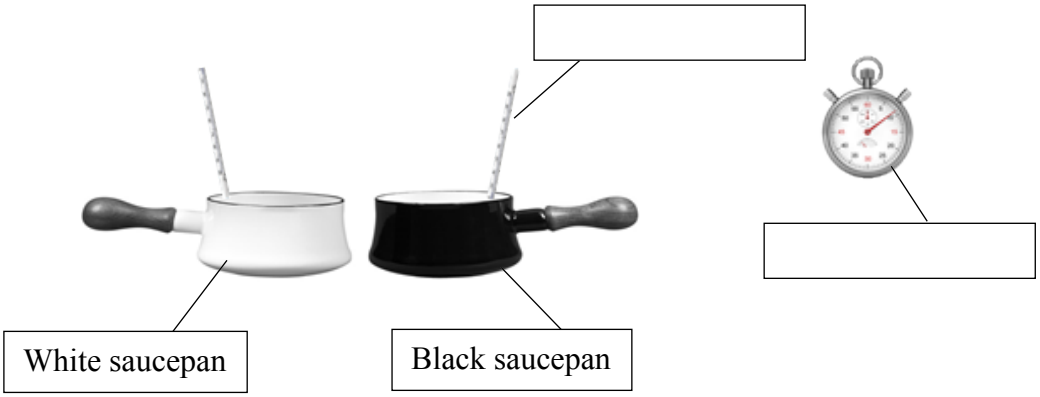
_____ **[1]**

ii) State on which rod the wax will melt in the shortest time. Explain.

_____

_____**[2]**

e) Liam and Emily found two saucepans of the same size but of different colour. One was black and one was white. They wanted to investigate which one is the best emitter of heat.



i) Fill in the missing labels in the diagram above. **[2]**

ii) They used the above setup to carry out their investigation. Using numbers from 2 to 5, put the sentences below in the correct order.

Pour equal amount of boiling water in each saucepan.	
Set up apparatus as shown in the diagram.	**1**
Record initial temperature.	
Plot a graph of temperature vs time for each can and observe the result.	
Record temperature every 5 minutes.	

[2]

iii) From the experiment, they concluded that _____ surfaces are the _____ emitters of heat. **[1]**