CANBERRA SECONDARY SCHOOL

2019 Semestral Assessment 2

Secondary Two Express

0

SCIENCE

7 Oct 2019
1 hour 45 minutes
0820h – 1005h

Name: _____ ( ) **Class:** _____

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write your full name, class and index number in the spaces provided on the question paper and on any separate writing papers used.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** the questions in **Section A**. For each question, there are four possible answers, **A**, **B**, **C** and **D**. Choose the one you considered to be correct and record your choice in soft pencil on the **Optical Test Answer Sheet (OTAS).**

Answer **ALL** the questions in **Section B** in the spaces provided on the question paper. The intended marks for the question are given in the brackets at the end of the question or part question [ ].

Answer **ALL** the questions in **Section C** in the spaces provided on the question paper. The intended marks for the question are given in the brackets at the end of the question or part question [ ].

You may use a calculator for this examination.

A copy of the Periodic Table is printed on page 25.

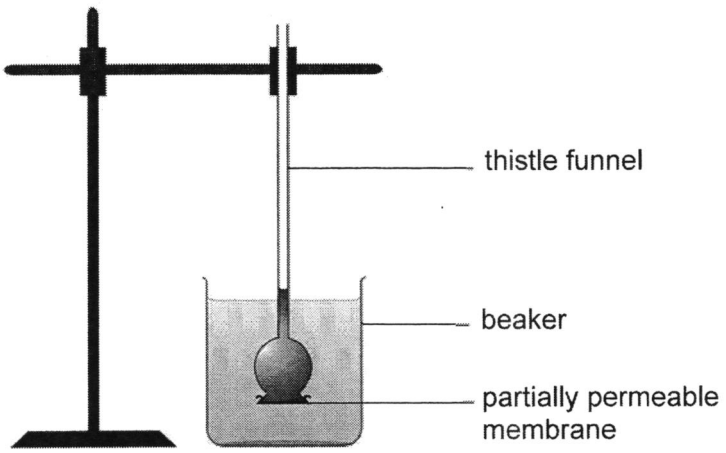
FOR MARKER'S USE		
Section	Marks Awarded	Max Marks
A		30
B		50
C		20
Total		100

This question paper consists of 25 printed pages including the cover page.

Setter: Mr Oon H L

Section A [30 marks]

1 An experiment was set up as shown. After an hour, the liquid level in the thistle funnel increased. Which of the following statements regarding the experiment is correct?



	process that has occurred	content in thistle funnel	content in beaker
A	osmosis	distilled water	sugar solution
B	osmosis	sugar solution	distilled water
C	diffusion	distilled water	sugar solution
D	diffusion	sugar solution	distilled water

2 Which line in the table that identify the main nutrient present in the food substance and the enzyme involved in the digestion of the food is correct?

	Food	Nutrient	Enzyme
A	bread	protein	protease
B	eggs	carbohydrate	amylase
C	milk	protein	protease
D	fish	fats	maltase

3 All living organisms are made up of cells. Which of the following statements about cells is **not** correct?

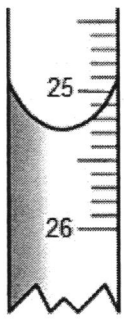
A The nucleus controls all the important activities of the cell.

B Chromosomes contain the genetic material.

C Vacuoles are found in both plant and animal cells.

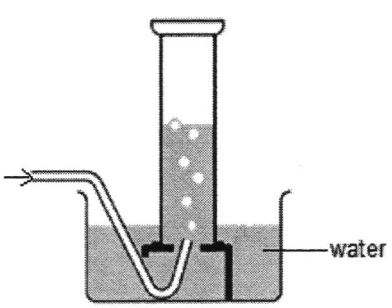
D Plant cells have a cell wall but no cell membrane.

4 The diagram below shows part of an apparatus containing a liquid.
What is the name of the apparatus and the reading shown?

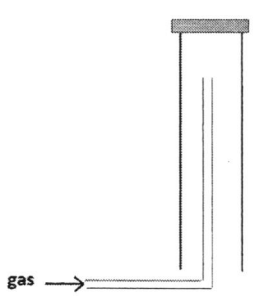


	name of apparatus	reading shown / cm^3
A	measuring cylinder	25.30
B	pipette	25.30
C	burette	25.00
D	burette	25.30

5 Carbon dioxide is slightly soluble in water and is denser than air.
Which of the following methods can be used to collect carbon dioxide?



1



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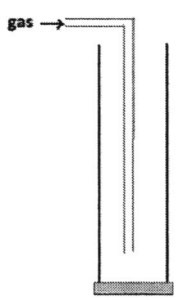


3

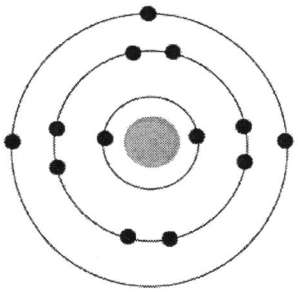
A **3** only

B **1** and **2** only

C **1** and **3** only

D **1**, **2** and **3**

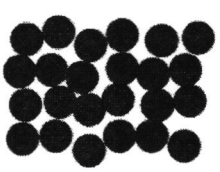
6 The diagram represents the structure of an atom of an element in the Periodic Table.



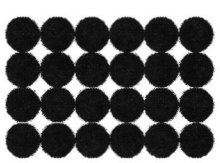
How many protons, electrons and neutrons does this atom have?

	protons	neutrons	electrons
A	10	13	13
B	13	27	13
C	13	14	13
D	14	13	14

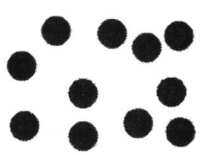
7 The diagrams below represent the arrangement of particles of the same substance in different states. Arrange them in ***increasing*** order of the forces of attraction between the particles.



X



Y



Z

A **X, Y, Z**

B **Z, Y, X**

C **Z, X, Y**

D **Y, X, Z**

8 The chemical formula of iron(III) sulfate is given as: $Fe_2(SO_4)_3$
How many elements and atoms are there in the chemical formula of iron(III) sulfate?

	number of elements	number of atoms
A	2	12
B	3	15
C	3	17
D	4	17

9 **Fig.9(a)** shows the zero error of a micrometer screw gauge and **Fig. 9(b)** shows the observed reading when it used to measure the diameter of a ball bearing.

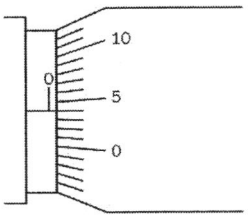


Fig. 9(a)

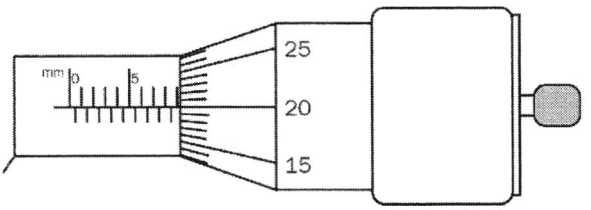


Fig. 9(b)

What is the zero error and the corrected reading?

	zero error / mm	corrected reading / mm
A	+0.04	9.24
B	-0.04	9.16
C	+0.04	9.16
D	+0.01	9.19

10 A simple pendulum takes 30 s to make 12 complete oscillations.
What is the period of the pendulum?

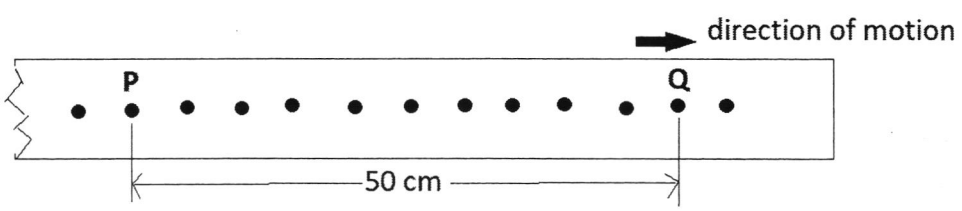
A 0.600 s

B 2.50 s

C 3.00 s

D 15.0 s

11 The diagram shows a strip of ticker tape that was pulled through a ticker tape timer that vibrated at 50 times a second. If the distance between point **P** and **Q** is 50 cm, what is the average speed at which the tape is moving?



A 2.50 m/s

B 5.00 m/s

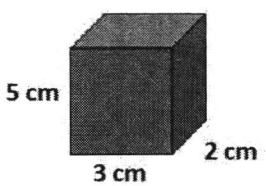
C 50.0 m/s

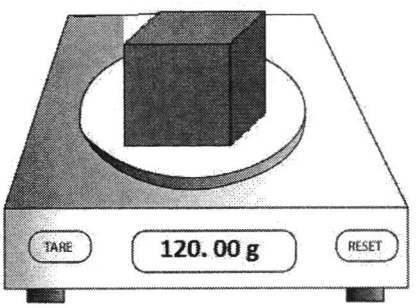
D 250 m/s

12 An astronaut took a rock which weighs 32 N on the Moon back to the Earth. What would be the mass and weight of the same rock on the Earth?
The gravitational field strength on the moon is 1.6 N/kg and on the Earth is 10 N/kg.

	mass of rock / kg	weight of rock / N
A	3.2	32
B	16	320
C	20	200
D	32	320

13 The diagram shows a block of metal with the given dimensions. Its mass was measured with an electronic balance as shown.





What is the density of the metal?

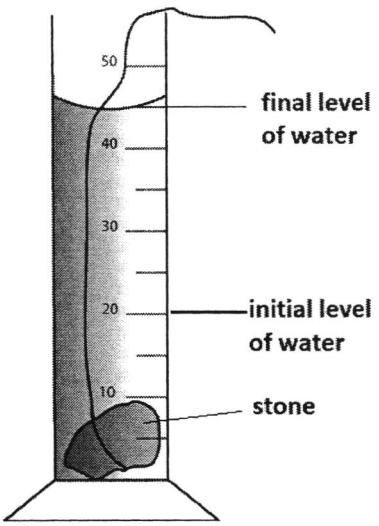
A 0.250 g/cm^3

B 4.00 g/cm^3

C 40.0 g/cm^3

D 400 kg/m^3

14 A measuring cylinder contains 20 cm^3 of water initially. When a stone of mass 60 g was placed into the measuring cylinder, the water level rose to 45 cm^3 as shown in the diagram below.



What is the density of the stone?

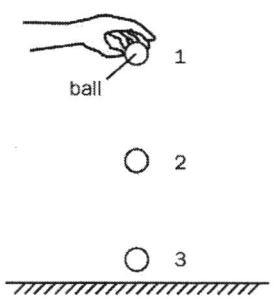
A 417 kg/m^3

B 1333 kg/m^3

C 2400 kg/m^3

D 3000 kg/m^3

15 The diagram shows a ball being released from rest at position 1.
What type(s) of energy does the ball have at position 1, 2 and 3?



	position 1	position 2	position 3
A	GPE	GPE + KE	KE
B	GPE	KE	KE
C	KE	KE + GPE	GPE + KE
D	GPE + KE	KE	KE

16 A car of mass 1200 kg is moving on a straight horizontal road at a constant speed of 25 m/s. What is the kinetic energy of the car?

A 15 kJ

B 300 kJ

C 375 kJ

D 375000 kJ

17 John pushed a box of mass 80 kg on a rough horizontal floor. He exerted a force of 300 N and the box moved over a distance of 20 m, what was the work done by John against friction?

A 1600 J

B 6000 J

C 7600 J

D 16000 J

18 Which of the following most accurately describes the energy change when a car accelerates up a hill?

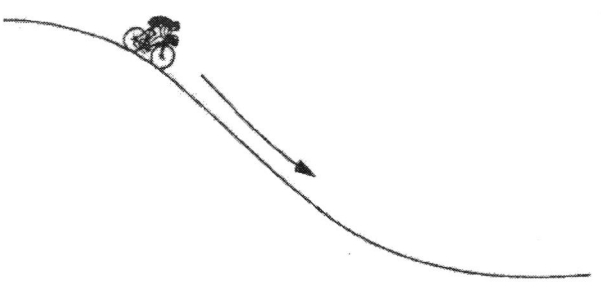
A It gains gravitational potential energy but loses kinetic energy.

B It gains kinetic energy but loses gravitational potential energy.

C It gains both kinetic and gravitational potential energy.

D It neither gains nor loses kinetic energy and potential energy.

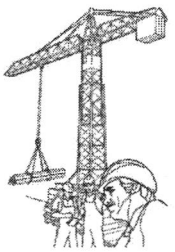
19 A cyclist accelerates down a slope as shown in the diagram.



Neglecting friction and air resistance, how does the cyclist's energy change?

	kinetic energy	gravitational potential energy
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

20 A crane lifts some metal bars of total mass 60 kg up to a height of 25 m.



If the crane takes 40 s to do the job, what is the power developed by the crane? Take the Earth's gravitational field strength as 10 N/kg.

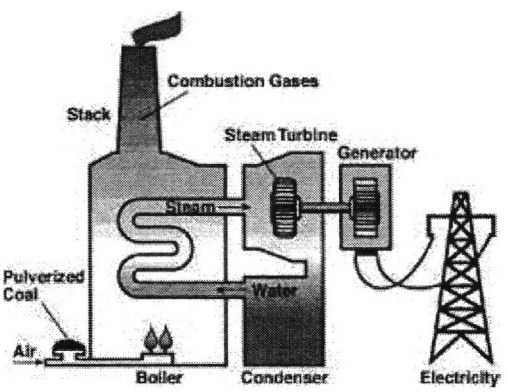
A 37.5 W

B 375 W

C 960 W

D 2400 W

21 Which one of the following represents the main energy changes that take place in a coal-fired power station?



A heat → chemical → kinetic → electrical

B chemical → kinetic → electrical → heat

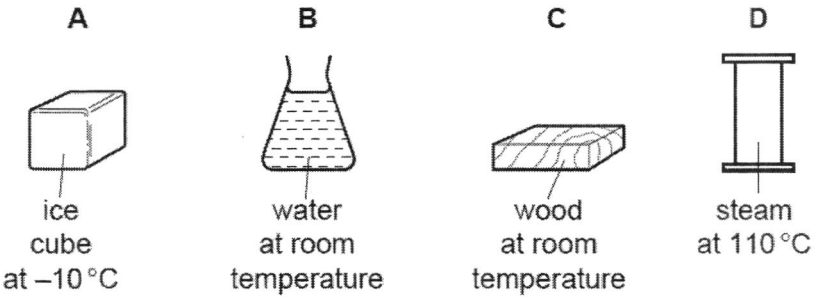
C electrical → heat → kinetic → chemical

D chemical → heat → kinetic → electrical

22 Some gas is placed in a sealed container that has a constant volume. What will happen to the gas molecules when the container is heated?

A They will expand.
B They will move further apart.
C They will move more rapidly.
D They will become less dense.

23 Which of the following contains the molecules with the highest average kinetic energy?



24 Which method(s) of heat transfer does **not** require a material medium?

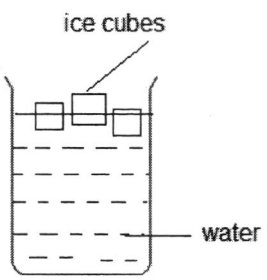
A radiation only

B conduction and radiation

C convection and conduction

D convection only

25 The diagram shows ice cubes used to lower the temperature of water in a beaker.



What is the main process by which the water at the bottom of the beaker cools?

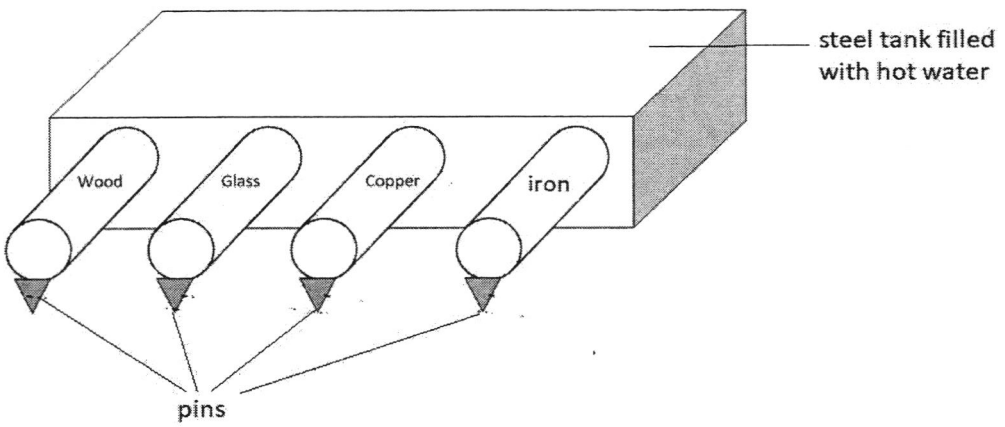
A conduction

B convection

C radiation

D diffusion

26 The diagram below shows an experiment to investigate the conduction of four different materials. Four rods, each with a pin attached to one end with wax, were inserted into a steel tank.



When hot water was poured into the tank, which pin would fall off first after a few minutes?

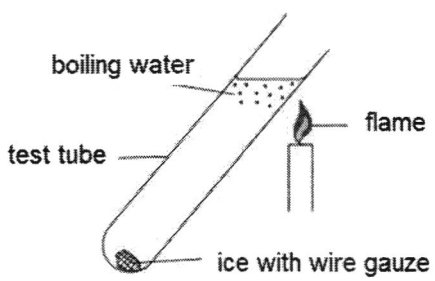
A wood

B glass

C copper

D iron

27 A piece of ice is held at the bottom of a test tube by wrapping it in a metal gauze, as shown in the diagram. The water at the top of the test tube is heated to its boiling point. It is observed that the ice inside the wire gauze melts very slowly.



What conclusion can be obtained from the above experiment?

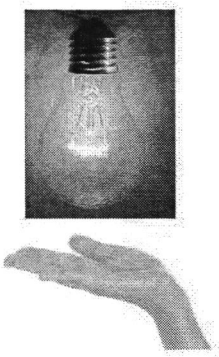
A The flame is not hot enough, so it cannot melt the ice.

B Heat cannot travel through the water by convection.

C Ice is a poor absorber of radiant heat.

D Water is a poor conductor of heat.

28 The diagram shows a hand placed below a lighted bulb.



By which process(es) do(es) most of the thermal energy reach the hand?

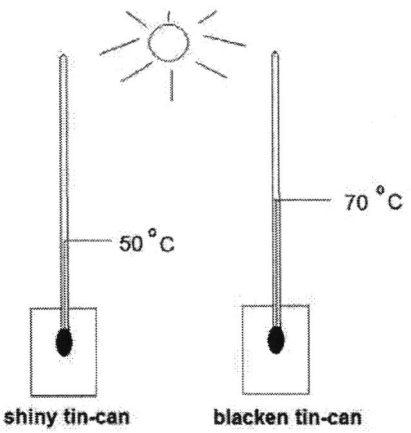
A conduction only

B convection only

C radiation only

D conduction and convection

29 The diagram shows an experiment conducted to investigate the transfer of thermal energy. A shiny and a blacken tin-can, each with a thermometer, is placed under the hot sun. After 2 hours, it was found that the temperature of the thermometer in each can has risen as shown in the diagram below.



Which of the following statements about the results of the experiment is correct?

A A shiny surface is a good conductor of thermal energy.

B A black surface is a good conductor of thermal energy.

C A shiny surface is a good emitter of thermal radiation.

D A black surface is a good absorber of thermal radiation.

30 When a liquid is freezing at its freezing point, which of the following correctly describe the change?

A The kinetic energy of the molecules increases.

B The potential energy of the molecules increases.

C The internal energy of the molecules decreases.

D Thermal energy is absorbed from the surroundings.

Section B (50 marks)

Answer **all** *the questions in this section.*

Write your answers in the spaces provided.

1 (a) Draw a large diagram to show the structure of an animal cell and name the following parts clearly:
nucleus, cytoplasm, cell membrane, vacuole and mitochondria.

[5]

(b) State **two** differences between an animal cell and a plant cell.

.....

.....

..... [2]

2 (a) Complete the following table to state the number of electrons, neutrons and protons in the atom and ion.

atomic symbol	number of		
	electron	neutron	proton
$^{39}_{19}K$			
$^{40}_{20}Ca^{2+}$			

[2]

(b) Complete the following table to state the formula of the compound formed between the cation and anion.

cation	anion	formula of compound
K^+	CO_3^{2-}	
Ca^{2+}	NO_3^-	

[2]

(c) Draw the electronic structure of a sodium atom.

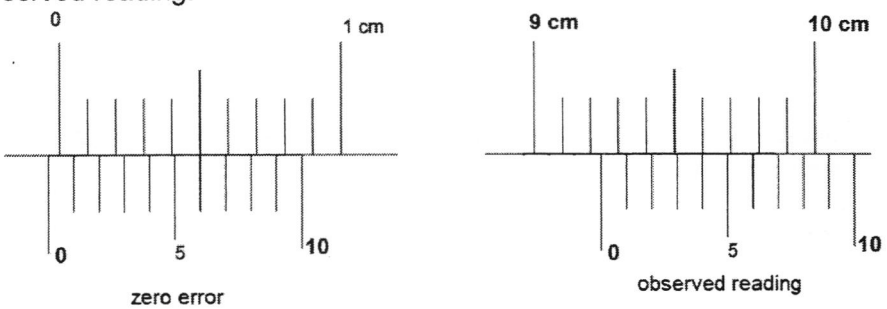
[1]

3 (a) Write down the symbol and factors for the following prefixes.
The first one is done for you as an example.

prefix	symbol	factor
milli	m	10^{-3}
kilo		
nano		

[2]

(b) A pair of vernier calipers was used to measure the length of a test tube. The diagram below shows the reading when the jaws were closed and the observed reading.



What is the zero error and the correct length of the test tube?

zero error: ..... [1]

correct length of test tube: ..... [1]

4 (a) State two differences between the mass and weight of a body.

1. .....

.....

2. .....

..... [2]

(b) **(i)** Explain what is 'inertia' and how it is related to the mass of a body.

.....

.....

..... [2]

(ii) The diagram shows two passengers standing inside a bus. The bus is moving towards the left.

Describe and explain what happens to the passengers if the bus suddenly stops.

.....

.....

..... [2]

5 **(a)** Define density of a substance and state the SI unit of density.

.....

..... [2]

(b) A metal alloy is made from a molten mixture of 600 g of aluminium and 200 g of magnesium. Aluminium has a density of 2.7 g/cm^3 while magnesium has a density of 1.74 g/cm^3.

(i) Calculate the volume of aluminium and magnesium used.

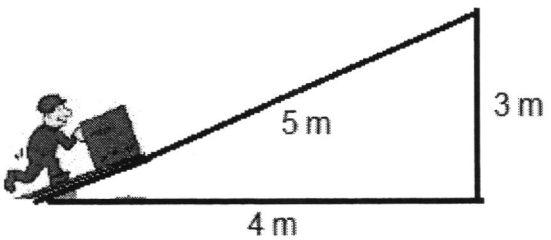
volume of aluminium = ... cm^3 [1]

volume of magnesium = ... cm^3 [1]

(ii) Calculate the density of the metal alloy.

density of alloy = ... g/cm^3 [2]

6 A man pushes a box of mass 80000 g that is initially at rest from the bottom to the top of a slope as shown in the diagram. Assume that the slope is smooth and take the Earth's gravitational field strength as 10 N/kg.



(a) State the law of conservation of energy.

.....

..... [1]

(b) Calculate the energy gained by the box at the top of the slope.

energy = ... J [2]

(c) State the amount of work done by the man to push the box up to the top of the slope. Give your reason.

.....

..... [2]

(d) Calculate the force the man used to push the box up the slope.

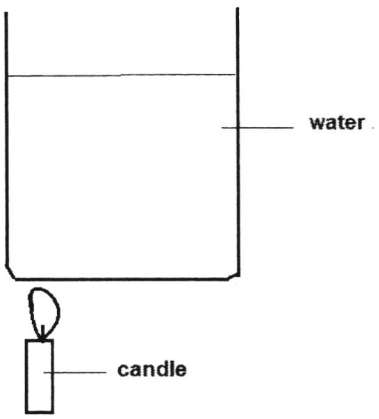
force = ... N [2]

(e) If the slope is not smooth, state and explain what effect this would have on the work done by the man.

.....

..... [2]

7 The diagram shows a beaker of water being heated by a candle on the left side.



(a) State the process heat from the candle flame is transferred through the glass to the water.

..... [1]

(b) Thermal energy is transferred within the water by the process called convection.

(i) Draw arrows to show the direction of the convectional currents in the water above. [1]

(ii) Explain clearly how convection currents are set up in the water until all the water achieve thermal equilibrium.

.....

.....

.....

..... [2]

(c) Explain why the cooling unit of the air-conditioner is not effective in cooling the room when it is placed near the floor of the room.

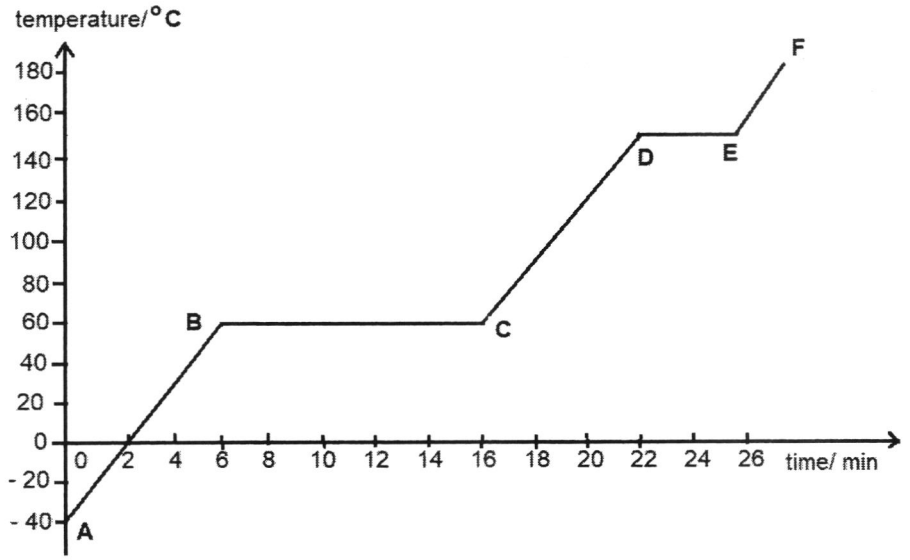
.....

.....

.....

..... [2]

8 A solid **X** was heated continuously by a 100 W heater from a temperature of -40°C until it changed completely into gas and achieved a temperature of 180 °C. A heating graph of the solid was plotted below.



Answer the following questions.

(a) State the melting point and boiling point of solid **X**.

melting point: .....

boiling point: .....

[2]

(b) State the physical state(s) of **X** in the period **B – C.**

..... [1]

(c) State the changes in the potential and kineticl energy of **X** during the period **D – E.**

.....

..... [2]

(d) Calculate the total amount of thermal energy supplied by the heater during the period **B – C.** Assume there is no heat loss to the surroundings.

energy = ... J [2]

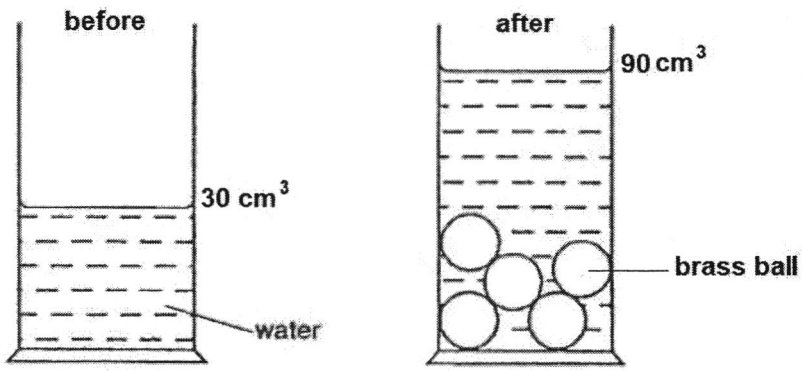
~End of Section B~

Section C (20 marks)

Answer **ALL** the *questions in this section.*

Write your answers in the spaces provided.

C1 (a) Five identical brass balls, each of mass 98 g, are dropped into a measuring cylinder containing water as shown in the diagram.



(i) Calculate the density of the brass balls, giving your answer in kg/m^3.

density = ... [2]

(ii) One of the brass balls is placed in a beaker containing liquid mercury which has a density of 13600 kg/m^3. State whether the brass ball will sink or float in mercury. Give your reason.

.....

.....

..... [2]

(iii) If the brass balls were brought to the moon which has a lower gravitational field strength than that of the Earth, state and explain if the density of the brass balls will change.

.....

.....

..... [2]

(b) Two liquids **X** and **Y** have densities of 0.8 g/cm^3 and 1.2 g/cm^3 respectively. 200 cm^3 of **X** is added to 84 g mass of **Y**. They mix uniformly without any volume change.

(i) Calculate the mass of liquid **X** and the volume of liquid **Y** that are mixed together.

mass of liquid **X** = ...

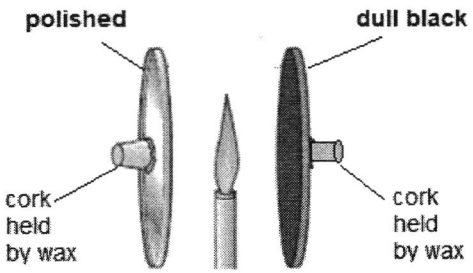
volume of liquid **Y** = ... [2]

(ii) Calculate the density of the mixture.

density of mixture = ... [2]

[Total: 10]

C2 **(a)** The diagram shows an experimental setup to investigate the effects of surface colours and textures on the rate of thermal radiation.



(i) Describe what would happen to the corks after a few minutes.

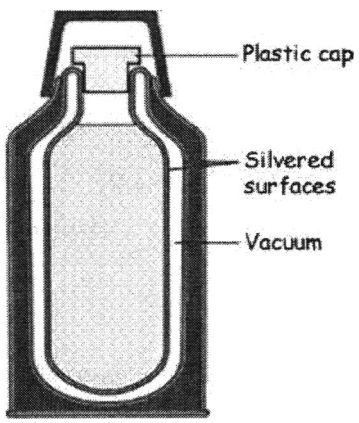
.....

..... [2]

(ii) State the conclusion of the above experiment.

..... [1]

(b) The diagram shows a thermos flask used to keep hot liquids hot.



Explain how the features of the flask prevent the loss of thermal energy.

plastic cap: .....

.....

outer silvered surfaces: .....

.....

vacuum: .....

..... [3]

(c) State two differences between boiling and evaporation.

.....

.....

..... [2]

(d) Explain, in terms of the kinetic particle theory, why evaporation causes a cooling effect.

.....

.....

.....

..... [2]

Total: [10]

~ End of paper ~

MARKING SCHEME

SEC 2EXPRESS SCIENCE SA2 2019

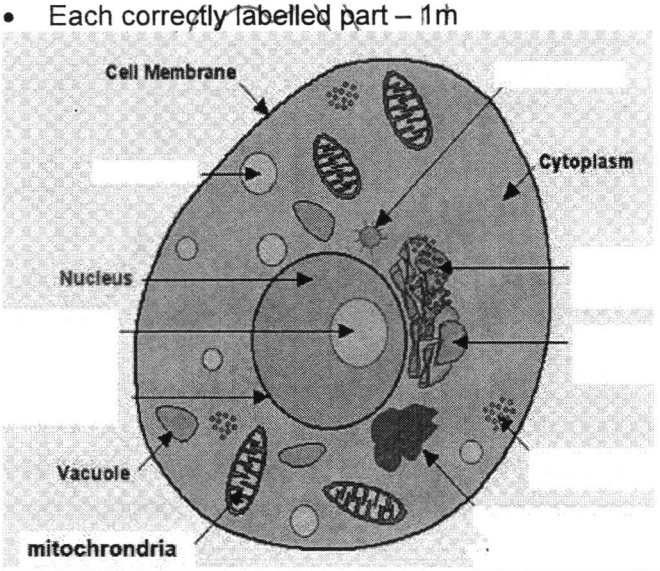
SECTION A (MCQ)

1	**B**	11	**A**	21	**D**
2	**C**	12	**C**	22	**C**
3	**D**	13	**B**	23	**D**
4	**D**	14	**C**	24	**A**
5	**C**	15	**A**	25	**B**
6	**C**	16	**C**	26	**C**
7	**C**	17	**B**	27	**D**
8	**C**	18	**C**	28	**C**
9	**C**	19	**B**	29	**D**
10	**B**	20	**B**	30	**C**

SECTION B (46 marks)

1 (a)

- Each correctly labelled part – 1m



max [5]

(b) Any two :

Animal cell	Plant cell
No cell wall	**Has a cell wall**
Small numerous vacuoles	**Few large vacuole**
No chloroplasts	**Has chloroplasts**

max [2]

2 (a)

atomic symbol	number of		
	electron	neutron	proton
$^{39}_{19}K$	**19**	**20**	**19**
$^{40}_{20}Ca^{2+}$	**18**	**20**	**20**

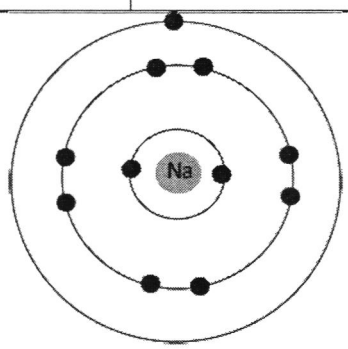
Each row 1 m [2]

(b)

cation	anion	formula of compound
K^+	CO_3^{2-}	**K_2CO_3**
Ca^{2+}	NO_3^-	**$Ca(NO_3)_2$**

1 m each [2]

(c)



[1]

3 (a)

prefix	symbol	factor
milli	m	10^{-3}
kilo	**k**	**10^{3}**
nano	**n**	**10^{-9}**

each row 1m [2]

(b) zero error: **- 0.04 cm** [1]

correct length of test tube: **9.28 cm** [1]

(No unit – ½ m)

4 (a) Any two:

- Mass is the amount of matter in a body; weight is the attraction of gravity on a body.
- Mass remains constant irrespective of its location; weight varies according to location/force of gravity.
- Mass is measured in kilograms; weight is measured in newtons.
- Mass is measured with a beam balance; weight is measured with a spring balance/newton meter.

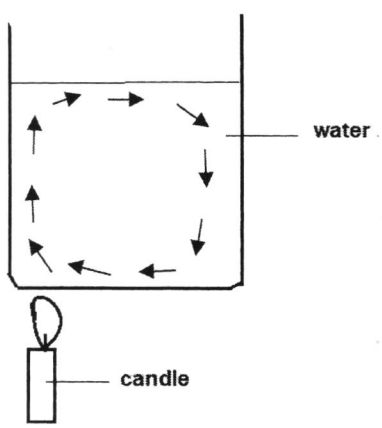
Max [2]

(b) (i) Inertia is the reluctance of a body to change its state of motion / reluctance of a body to start moving when it is at rest and to stop moving when it is moving. [1]

The greater the mass a body, the **greater the inertia.** [1]

(ii) The passengers will **move/jerk to the left.** [1]
(No mark awarded if no direction or wrong direction is given).

Due to inertia, the passengers will continue to move to the left even though the bus has stopped. [1]

5	(a)	**Density is the mass per unit volume of a substance.** (No mark awarded if given as mass divide by volume) **S.I. unit is kg/m^3 or kilogram per cubic metre.**	[1] [1]
	(b) (i)	**Volume of Al = $\frac{600}{2.7}$ = 222.2 cm^3 / 222 cm^3** **Volume of Mg = $\frac{200}{1.74}$ = 114.9 cm^3 /115 cm^3**	[1] [1]
	(ii)	**Density of alloy = $\frac{\text{mass}}{\text{volume}}$** **= $\frac{800\ \text{g}}{337.1\ \text{cm}^3}$** **= 2.373** **= 2.37 g/cm^3 (3 s.f.)** (Not corrected to 3 s.f. , minus ½ mark)	[1] [1]
6	(a)	The law of conservation of energy states that energy cannot be destroyed or created. It can only be converted.	[1]
	(b)	GPE = mgh (½ m) = 80 x 10 x 3 (1 m) = 2400 J (1 m)	max [2]
	(c)	Work done = 2400 J (1) By the conservation of energy, work done is equal to gain in GPE.(1)	[2]
	(d)	W = F x d (½ m) F x 5 = 2400 (1 m) F = 2400 ÷ 5 (½ m) = 480 N (1 m)	[2]
	(e)	The **work done would be more** / He would **use more energy** (1) to **overcome friction.** (1)	[2]
7	(a)	**By conduction**	[1]
	(b) (i)	 	[1]
	(ii)	The water at the bottom got heated up first and it expands. ($^1/_2$) Its density decreases ($^1/_2$) and rise to the top ($^1/_2$) of the beaker.	

		The cold water on the top is denser ($^1/_2$) and it sinks to take its place. ($^1/_2$). It is in turn heated, becomes less dense and rises ($^1/_2$). This sets up a convectional current.	max [2]
	(c)	This because the cold air from the air-con is denser ($^1/_2$) and it cannot rise(½) Convection (current) is not set up. ($^1/_2$)	max [1]
8	(a)	melting point = **60 °C** boling point = **150 °C**	[1] [1]
	(b)	solid + liquid (no marks if only 1 state is given)	[1]
	(c)	Average **PE increases** (1) Average **KE remains constant**/ same (1)	[2]
	(d)	Time taken = 10 min = 600 s (½) Energy = Power x time (½) = 100 W x 600 s (1) = **60000 J** (½)	max [2]

SECTION C

C1	(a) (i)	Volume of 5 balls = 60 cm^3 Volume of 1 ball = 60 ÷ 5 = 12 cm^3 (½ m) Density of brass = mass ÷ volume = 98 g ÷ 12 cm^3 (½ m) = 8.17 g/cm^3 (½ m) = 8.17 x 1000 = **8170 kg/m^3** (½ m)	[2]
	(ii)	It will float on mercury (1) because the density of the brass ball is less than the density of mercury. (1)	[2]
	(iii)	Density will not change /unchanged (1) The volume and mass of the brass ball remains the same/unchanged(1)	[2]
	(b) (i)	Mass of liquid **X** = volume x density = 200 x 0.8 = **160 g** (1 m) Volume of liquid **Y** = mass ÷ density = 84 ÷ 1.2 = **70 cm^3** (1 m)	[2]
	(ii)	Total mass of mixture = 160 + 84 = 244 g (½ m) Total volume of mixture = 200 + 70 = 270 cm^3 (½ m) Density of mixture = total mass / total volume = 244 g / 270 cm^3 (½ m) = **0.904 g/cm^3** (3 s.f.) (½ m) (No unit or wrong unit minus ½ m)	[2]

<table>
<tr><td>C2</td><td>(a)
(i)

(ii)</td><td>The wax on the dull black surface will melt first and the cork felll off. (1)
Then a few minutes later, the wax on the polish surface melted and the cork fell off. (1)

A <u>black dull surface is a better absorber of radiant energy</u> (heat) compared to a shiny / polish surface.</td><td>[2]

[1]</td></tr>
<tr><td></td><td>(b)</td><td><u>Plastic cap: reduces heat/thermal energy loss by conduction as plastic is a poor conductor</u>.(1) <u>It also prevents convection by stopping the hot vapour from leaving the flask</u>. (1)

<u>Outer silvered glass surfaces: reduces heat/thermal energy loss through radiation as a silvered surface is a poor radiator. (1)</u>

<u>Vacuum: prevents heat/thermal energy from being lost by conduction and convection</u> (1) as there is no material medium.</td><td>max [3]</td></tr>
<tr><td></td><td>(c)</td><td>Any two: 1 m each
<table><tr><th>Boiling</th><th>Evaporation</th></tr><tr><td>• Occurs at a fixed temperature
• Occurs throughout the liquid
• Needs an external source of thermal energy
Temperature remains constant during boiling</td><td>• Occurs at any temperature
• Occurs at the surface
• Absorbs thermal energy from the surroundings
• Temperature of the liquid drops</td></tr></table></td><td>[2]</td></tr>
<tr><td></td><td>(d)</td><td>Molecules near the surface of the liquid have more kinetic ener
and they move so rapidly that some of them have enough energy(½) leave the liquid surface and become a gas(½).
The molecules left behind have lower kinetic energy(½) and hence they are at lower temperature(½).</td><td>max [2]</td></tr>
</table>