

Name:	Target Grade:	Actual Grade:
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PHYSICAL PROPERTY MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.
2. Spend one minute on each mark.
3. Time yourself for every single question.
4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.
5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.
6. Highlight question types that you tend to keep making mistakes and review them nearing exams.
7. Always review the common questions and question type that you tend to make mistakes nearing exams.
8. During exams, classify the question type and recall what you have learnt, how you need to analyse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

🌟 Wishing you all the best for this test!

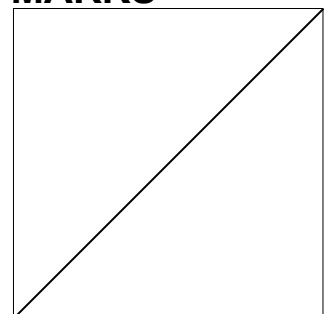
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💡 With lots of love,
Bright Culture 🧡

If you are struggling in this paper, means you need to work harder!

If you need any professional guidance and further advice on how to advance, feel free to WhatsApp us at 91870820 or find us at www.bright-culture.com/. We are committed to connect you to your future to reach your goals.

MARKS

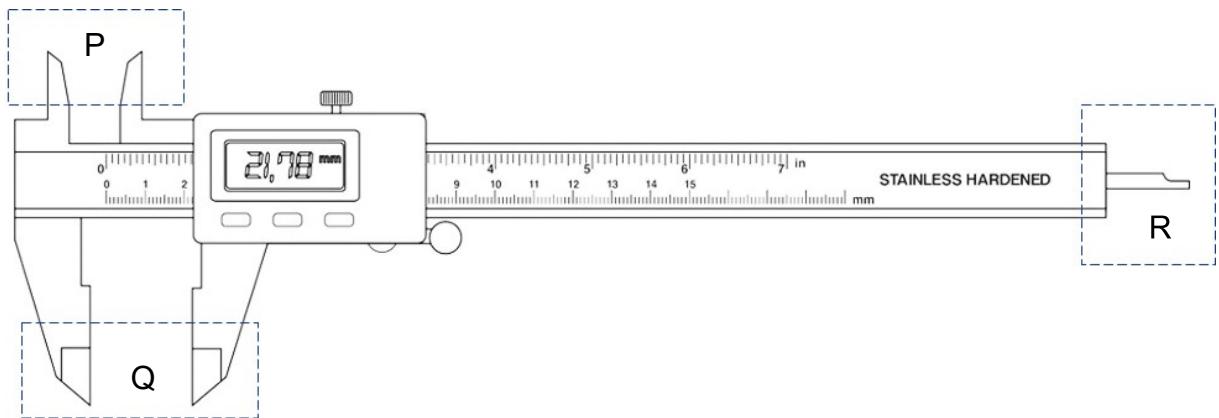


PHYSICAL PROPERTY MCQ

- 1 Which of the following has the best definition of a *hypothesis*?
- A** It is a possible explanation for experimental observations.
B It is the clarification of issues through questioning.
C It is the conclusion drawn from the experiment.
D It is the exploring of all alternatives and possibilities over the obvious choice.
- 2 A student decides to design an experiment to compare how sunlight affects the growth of a plant.

Which variable is essential to ensure a fair test?

- A** conduct the experiment in the laboratory
B measure the time taken for the plant to grow
C supply equal amount of nutrients to each plant
D use the same measurements of the plant pot
- 3 The diagram below shows parts (P, Q, R) of a digital caliper.



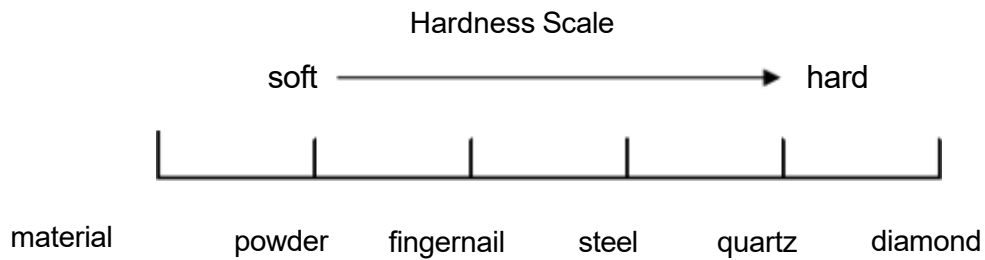
Which part(s) of the caliper should be used to measure the internal diameter of a test-tube?

- A** P only
B Q only
C R only
D P and Q
- 4 Which pair of apparatus should be used to determine the volume of an irregular solid?
- A** burette and displacement can
B burette and pipette
C displacement can and measuring cylinder
D pipette and measuring cylinder

5 Which of the following about a luminous and non-luminous Bunsen flame is **incorrect**?

	luminous flame	non-luminous flame
A	air hole is closed	air hole is opened
B	orange in colour	blue in colour
C	produces soot	does not produce soot
D	hotter	less hot

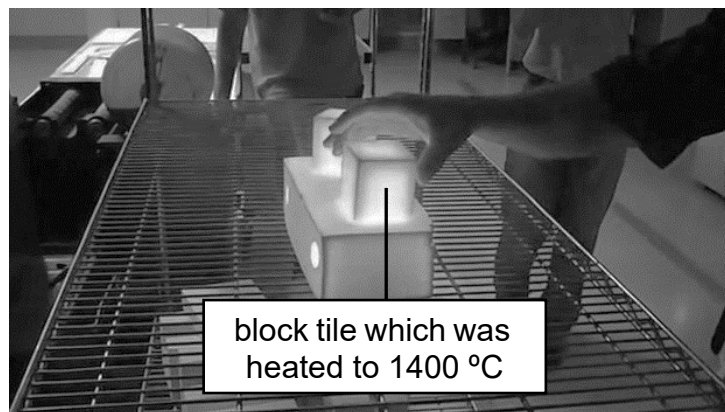
6 The hardness scale for 5 different materials is shown below:



Which statement is true?

- A** Fingernail is able to scratch quartz but not steel.
- B** Powder is able to scratch diamond.
- C** Quartz is only able to scratch one substance.
- D** Steel is unable to scratch quartz.

- 7 Based upon the scientific method, in what order are the initial stages of a scientific investigation carried out?
- A hypothesis → experiment → question → observe
B hypothesis → question → experiment → observe
C observe → question → hypothesis → experiment
D observe → hypothesis → question → experiment
- 8 Which of the following **cannot** be investigated by conducting scientific experiments?
- A How the motion of distant stars and planets affect an individual's personality.
B How the density of an object affects whether it will sink or float in water.
C How the surface area of an object affects the rate at which it falls to the ground.
D How adding fertiliser to soil affects the height of plants as they grow.
- 9 Which of the following statements about Science are true?
- I Scientists know everything about the natural world with absolute certainty.
II Scientists may explain the same phenomena in slightly different ways.
III Scientists may change their minds in the light of new evidence.
IV Scientists can obtain a wide range of different results for the same experiment.
- A I and II only B II and III only
C II and IV only D III and IV only
- 10 The diagram below shows a person touching a block tile which was heated to 1400 °C.



Which property of the block allows the person to touch the block and not get hurt?

- A poor hardness B high melting point
C good electrical conductivity D poor thermal conductivity

11 Which of the following substances is a **liquid** at room temperature (25°C)?

Substance	melting point / °C	boiling point / °C
A	35	79
B	-56	73
C	-134	12
D	-138	1

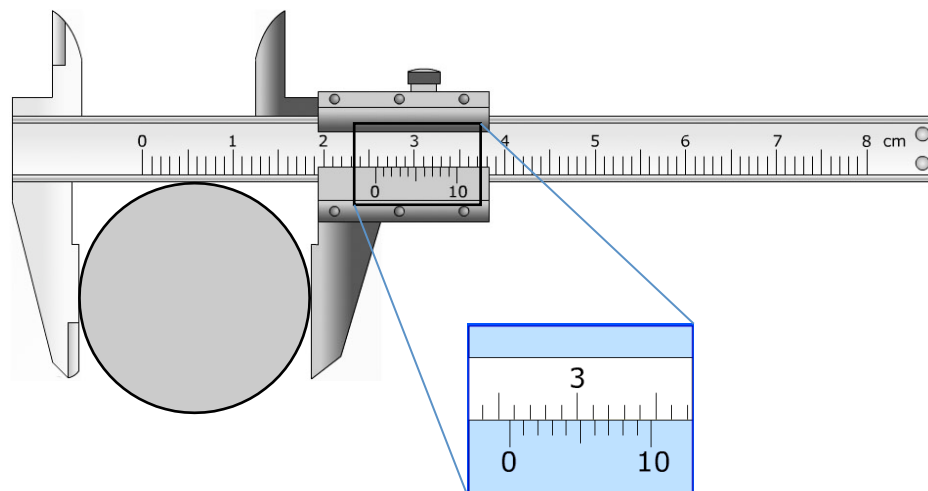
12 Which of the following physical properties describes the ability to withstand scratches and to scratch another material?

- A elasticity
- B flexibility
- C hardness
- D strength

13 To avoid making errors when taking measurements, which of the following needs to be checked on the instrument first before taking reading?

- A it is calibrated in SI base unit
- B it has half divisions
- C there is no parallax error
- D there is no zero error

14 A pair of vernier calipers calibrated in centimetre is used to take a measurement of a circular object as shown below.

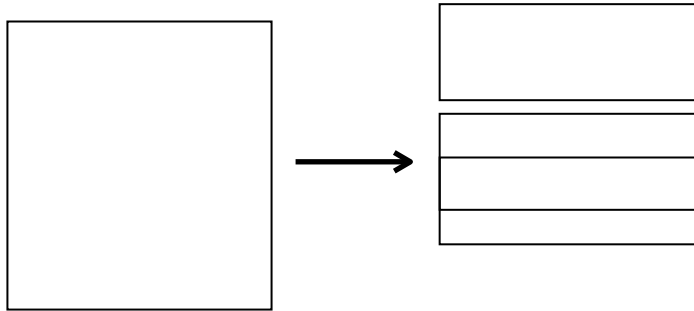


What is the reading on the vernier calipers?

- A 2.57 cm
- B 3.07 cm
- C 3.20 cm
- D 3.27 cm

- 15 Which of the following is a correct definition of classification?
- A Classification is the method of dividing things into groups according to different properties.
 - B Classification is the method of dividing things into groups according to the same property.
 - C Classification is the method of dividing things into groups according to similar properties.
 - D Classification is the method of dividing things into groups according to two similar properties.

- 16 A large wooden plank is cut into three equal pieces.



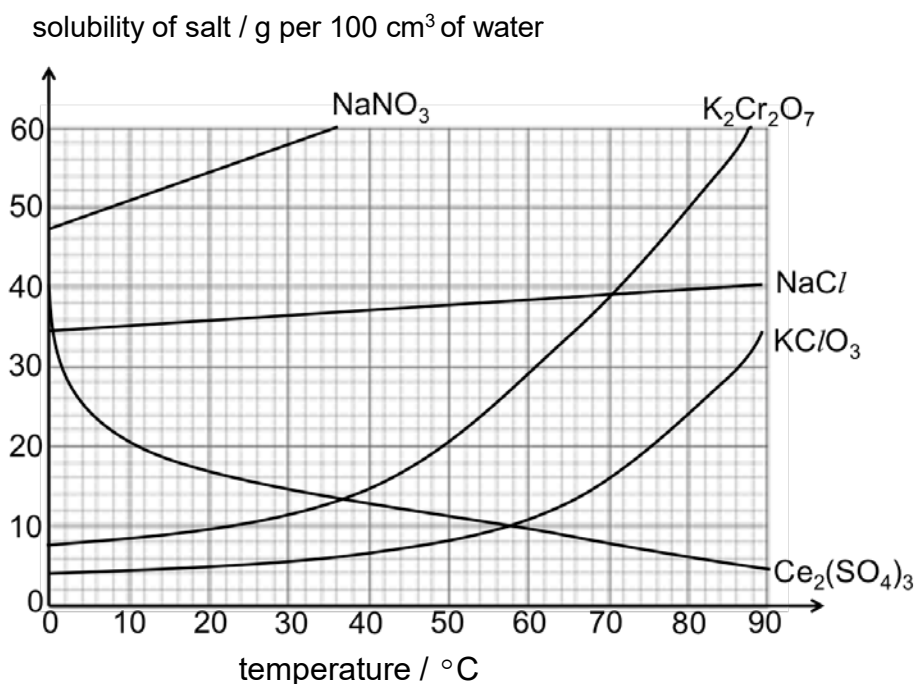
Which statement about the wooden planks' densities is correct?

- A The density of each individual plank is half that of the original piece.
 - B The density of each individual plank is the same as the original piece.
 - C The density of each individual plank is three times larger than the original piece.
 - D The density of each individual plank is three times smaller than the original piece.
- 17 In mining fields, drills are used to remove rock formation blocking access to the valuable ores beneath. The intense drilling also generates high amount of frictional heat.
- Which combination of physical properties is of highest concern when considering the material used to make the drill?
- A hardness, electrical conductivity, boiling point
 - B hardness, strength, melting point
 - C strength, electrical conductivity, thermal conductivity
 - D strength, melting point, transparency

- 18 A student has extracted an essential oil from the lemongrass plant found in Singapore using water.
- The mixture in water is cloudy, but it becomes clear after the student adds and shakes the mixture with ethanol (alcohol).

What does this observation show?

- A Ethanol is insoluble in water.
 - B The essential oil is soluble in water.
 - C The essential oil is soluble in ethanol but insoluble in water.
 - D The essential oil and ethanol are both soluble in water.
- 19 The following graph shows how the solubility of nine salts in water varies with temperature.



Which statement is correct?

- A KClO₃ has a higher solubility in water than NaCl.
- B NaCl and K₂Cr₂O₇ have the same solubility at approximately 70 °C.
- C The solubility of NaNO₃ is 50 g per 100 cm³ of water at 30 °C.
- D The solubility of many salts decreases rapidly with temperature.

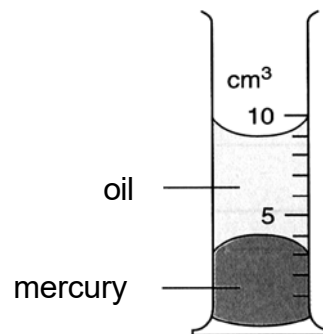
20 Which of the following shows the correct S.I. unit for all three physical quantities?

	Physical Quantities		
	Mass	Time	Temperature
A	gram	second	celsius
B	kilogram	hour	celsius
C	kilogram	second	kelvin
D	milligram	minute	kelvin

21 The Vernier calipers can be used to measure all of the following items **except** the

- A** depth of a test tube
- B** external diameter of a ping pong ball
- C** internal diameter of a water hose
- D** length of your Science file

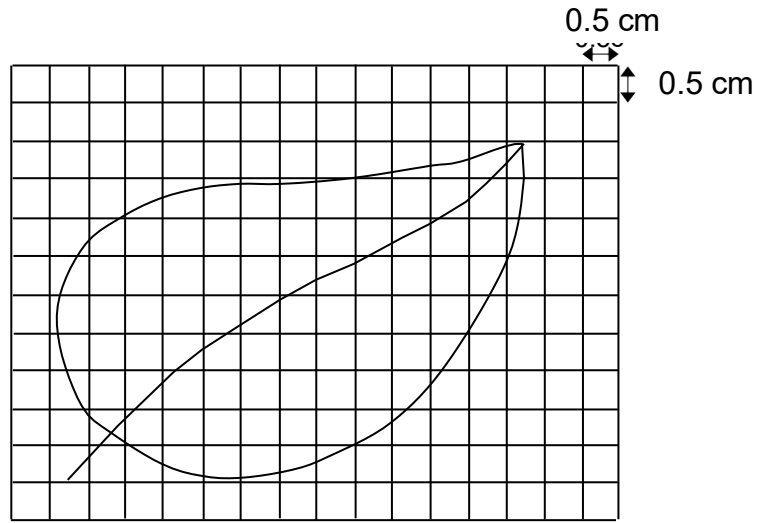
22 The diagram shows a measuring cylinder containing some oil and mercury.



What is the volume of oil in the measuring cylinder?

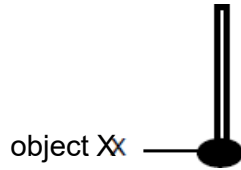
- A** 4 cm³
- B** 5 cm³
- C** 9 cm³
- D** 10 cm³

23 What is the approximate area of the leaf as shown in the diagram below?

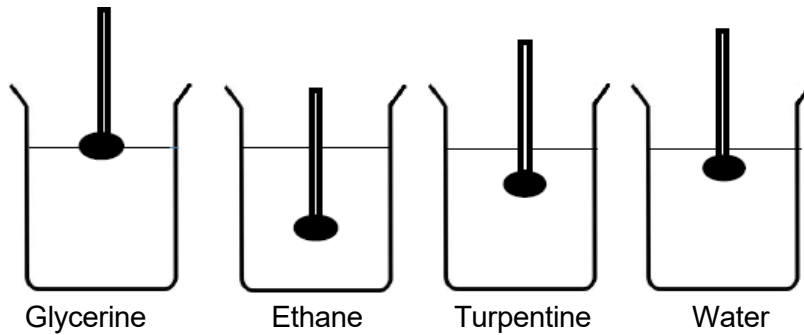


- | | | | |
|----------|--------------------|----------|--------------------|
| A | 16 cm ² | B | 20 cm ² |
| C | 36 cm ² | D | 80 cm ² |

24 A straw loaded with object X is shown below.



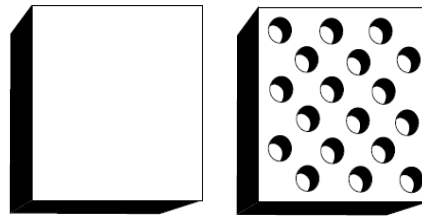
Its relative positions when placed in various liquids are shown in the diagram below.



Which liquid has the lowest density?

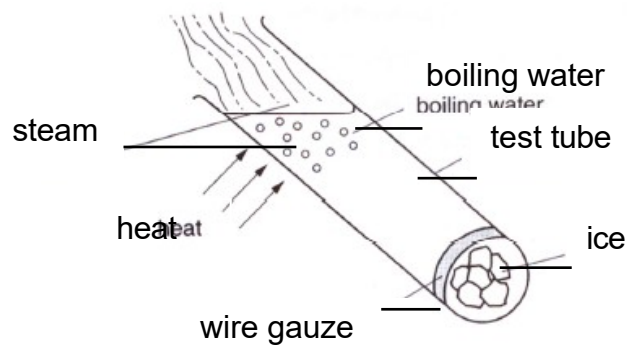
- | | | | |
|----------|------------|----------|-----------|
| A | Ethane | B | Glycerine |
| C | Turpentine | D | Water |

- 25 May had a thin, solid piece of material. She placed the material in water and it floated. She took the material out and punched holes all the way through it.



What will May observe when she puts the material with holes back in the water?

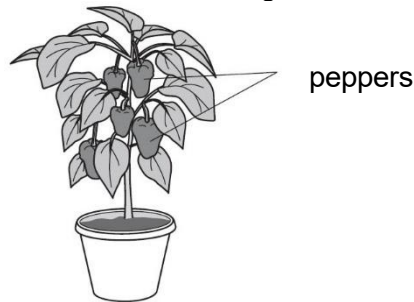
- A It will sink.
 - B It will barely float.
 - C It will float the same as before.
 - D It will neither sink nor float. It will bob up and down in the water.
- 26 Boiling water and ice can exist at the same time in a test tube. What does this experiment show?



- A Convection occurs in water.
- B Wire gauze is a good reflector of heat.
- C Wire gauze has a higher density than water.
- D Water does not conduct heat well.

PHYSICAL PROPERTY STRUCTURE QUESTIONS

- 1 Avani wants to investigate the effect of adding fertiliser to pepper plant.



Avani conducts her investigation adding one of six fertilisers (A to F) that contain different percentage by mass of nitrogen, phosphorus and potassium to the soil of six different plant pots.

Table 1.1 shows the results of Avani's experiment.

Table 1.1

fertiliser	percentage by mass in each fertiliser			number of peppers produced
	nitrogen	phosphorus	potassium	
A	20	40	40	98
B	30	30	40	78
C	30	35	35	76
D	30	40	30	77
E	40	30	30	56
F	50	25	25	42

- (a) Suggest a suitable hypothesis for the above experiment.

.....

.....

[1]

- (b) To make it a fair test, Avani keeps the following factors constant:
- size of pot
 - amount and type of soil
 - size and type of plant at the start
 - amount of fertiliser

State two other factors that she must keep constant.

.....

.....

[1]

- (c) Her friend Min Dee says that Avani should grow more pots of pepper plants using each fertiliser. Explain the reason for Min Dee's suggestion.

2 In the lab, some apparatus can be used to measure or hold liquids.

- a. Explain why the conical flask is **not** suitable to measure precise volumes of liquids.

.....
 [1]

- b. The conical flask is used to handle hydrogen peroxide, H₂O₂, which has the following symbols.



Name all 3 symbols and suggest an appropriate safety precaution when handling hydrogen peroxide.

.....
 [2]

- c. Fig 3.1 shows apparatus X, that is used to determine the volume of liquids. Fig 3.2 shows a close-up of the liquid level.

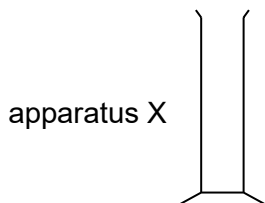


Fig 3.1

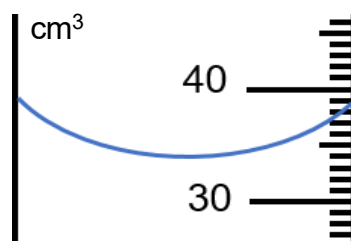


Fig 3.2

- (i) Name apparatus X. [1]
- (ii) State the volume of liquid in X. [1]
- (iii) Suggest a precaution during the measurement process to ensure that the volume reading is accurate.

{1}
 [1]

- 3 Alice carried out an experiment for a school project. She filled one petri dish with 50 cm³ of a high sugar soda drink, a second petri dish with 30 cm³ of a low sugar soda drink, and a third petri dish with 40 cm³ of distilled water. A summary of her experiment is given in **Fig. 1.1**.

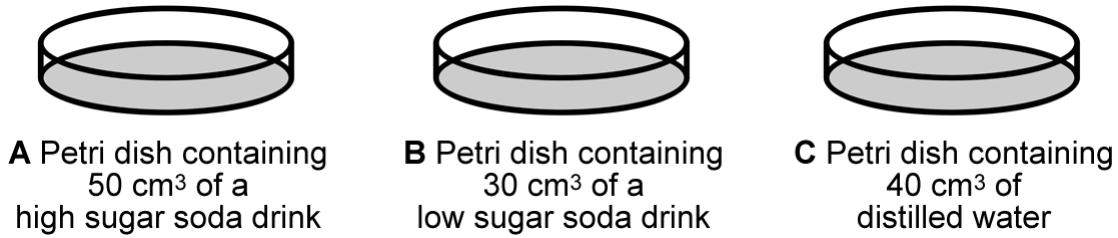


Fig. 1.1

Alice conducted her experiment once. She left the three petri dishes in her school's ecology garden and counted the number of honeybees that visited each solution over periods of 10 minutes for 1 hour. Her results are given in **Table 1.1**.

time / minutes	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
number of honeybees that visited the high sugar soda drink A	7	9	12	8	10	11
number of honeybees that visited the low sugar soda drink B	2	4	4	3	5	3
number of honeybees that visited the distilled water C	0	0	0	1	0	1

Table 1.1

- (a) State Alice's hypothesis for this experiment. [1]

.....

.....

- (b) State Alice's control for this experiment. [1]

.....

.....

- (c) Identify **two** errors that Alice made in the design of this experiment. [2]

.....

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[Total = 6 marks]

4 (a) Define *density*. [1]

(b) Fig. 1.1 shows the cross-sectional view of a submarine.

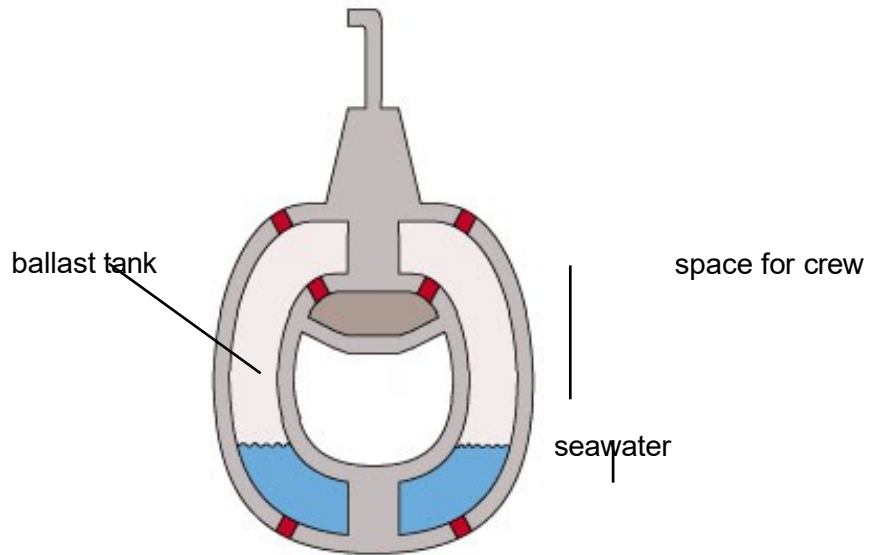


Fig. 1.1

A submarine is able to rise or sink in the sea by releasing seawater from its ballast tanks and taking in seawater into its ballast tanks respectively.

(i) Explain how the submarine is able to float and sink in the sea by releasing seawater and taking in seawater. [2]

- (ii) A submarine has a volume of 2730 m^3 and mass of 210 000 kg when it carries a full load of crew and equipment but without any seawater in its ballast tanks.

If the density of seawater is 1030 kg / m^3 , calculate the mass of seawater that is required to be taken into the ballast tanks for it to sink in the sea.

[2]

mass of seawater required=.....

Total [5]

- 5 Scientists investigated the effect of a certain mineral on the growth of wheat. Scientists divided 100 young wheat plants into 2 equal groups. One of the groups was grown in sterilised soil with the mineral added while the other group was grown in sterilised soil without the mineral added. Scientists repeated the experiment 2 more times before publishing their results in a scientific journal.

Use your knowledge of the Scientific Method to answer the following questions:

- (a) What is the likely hypothesis that you can write for this investigation?
[1]

- (b) Why was the soil in which the wheat plants were grown sterilised at the start of the investigation? [1]

- (c) Why did the scientists divide the young wheat plants into two equal groups? [1]

- (d) During the investigation, the scientists kept the two groups of plants under identical conditions. Why was this necessary? [1]

- (e) Name three conditions the scientists would have kept constant during the investigation. [3]

- (f) Why did the scientists repeat the investigation several times before publishing their results in a scientific journal? [2]

- (g) Suggest one safety precaution that scientists should take when undergoing these investigations. [1]

Total [10]

6 Emma bought a 50 g wooden cube from a store. The wooden cube is shown in Figure 1.1.



Figure 1.1

Emma places this wooden cube on an electronic balance. The electronic balance reading is 49.5 g.

(a) Emma feels that she was short-changed.

By examining the *precision* and *accuracy* of the reading of the mass of the wooden cube, explain if you agree with Emma.

[3]

.....

.....

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.....

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(b) Emma wants to find the density of the wooden block. Suggest what she must do to determine the density of the wooden block.

[3]

.....

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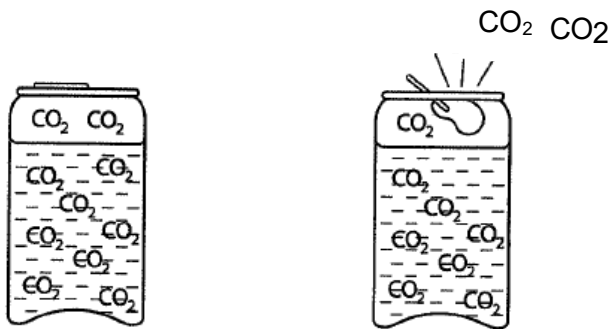
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Total [6]

7 The diagram below shows a carbonated drink containing sucrose ($C_{12}H_{22}O_{11}$) and dissolved carbon dioxide. The solubility of gases decreases with an increase in temperature.

Student 1 suggests that the carbonated drink is a solution while student 2 suggests that it is a suspension.



A drink can contains carbon dioxide dissolved in water under high pressure.

When the can is opened, the pressure is released and carbon dioxide leaves the water.

(c) (i) Identify the solutes and the solvent present in the carbonated drink. [2]

.....

(ii) Deduce from the diagram the effect of pressure on the solubility of carbon dioxide in water. [1]

.....

.....

(iii) Suggest one method to cause the release of more carbon dioxide from an open can of carbonated drink. [1]

.....

(d) (i) State one property of a solution and one property of a suspension. [2]

.....

.....

(ii) Explain whether student 1 or 2 was correct. [1]

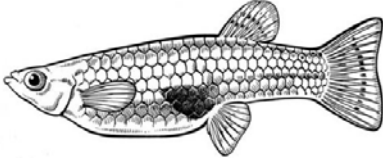

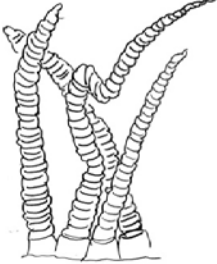
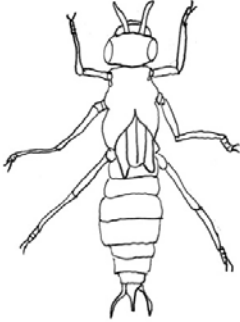
.....

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Total [7]

8 Table 4.1 shows some aquatic organisms that were found in a school pond.

Table 4.1

aquatic animal	characteristics
 <p data-bbox="587 517 671 551">guppy</p>	<ul style="list-style-type: none"> • swims in the water • whips tail to move • has fins
 <p data-bbox="550 891 703 925">fairy shrimp</p>	<ul style="list-style-type: none"> • swims in the water • does not have fins • does not whip tail to move • segmented body parts • 11 pairs of swimming legs
 <p data-bbox="544 1361 711 1395">tubifex worm</p>	<ul style="list-style-type: none"> • does not swim in the water • segmented body parts
 <p data-bbox="531 1973 724 2007">dragonfly larva</p>	<ul style="list-style-type: none"> • swims in the water by jet propulsion especially when threatened • segmented body parts • 3 pairs of legs

- a. Draw a dichotomous key, in the space given below, to classify the different organisms using the information provided in Table 4.1.

[4]

- b. Guppies were added to the school pond to control the population of mosquito larvae and prevent the breeding of mosquitoes.

Guppies are not native to Singapore. Suggest two reasons why the introduction of guppies into local waterways such as reservoirs and freshwater rivers may be a threat to the native fish populations.

[2]

.....

.....

.....

.....

Total [6]

- 9 An NYGH student uses the set-up below to investigate the pressure and volume inside a sealed gas syringe.

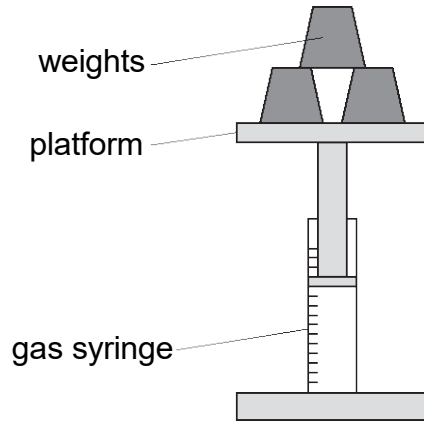


Figure 10.1

She records readings of the volume of gas as she increases the pressure from 50 kPa to 100 kPa by loading more weights onto the platform (loading).

She records readings of the volume of gas as she decreases the pressure from 100 kPa to 50 kPa by removing weights from the platform (unloading).

Table 10.2 below shows her results.

Table 10.2

pressure / kPa	volume of gas / cm ³		
	loading	unloading	average
50	101	101	101
55	90	x	92
60	85	83	84
84	60	60	60
90	56	54	55
100	50	50	50

- a. State the dependent variable in this investigation.
[1]

.....

b. Suggest a possible value for x in the table.

[1]

.....

.....

c. Suggest one variable that the student needs to control or keep constant to make the investigation a fair test, and explain how, if not kept constant, it could affect her results.

[2]

.....

.....

.....

d. Figure 10.3 below shows her results plotted on a graph, together with a best fit line.

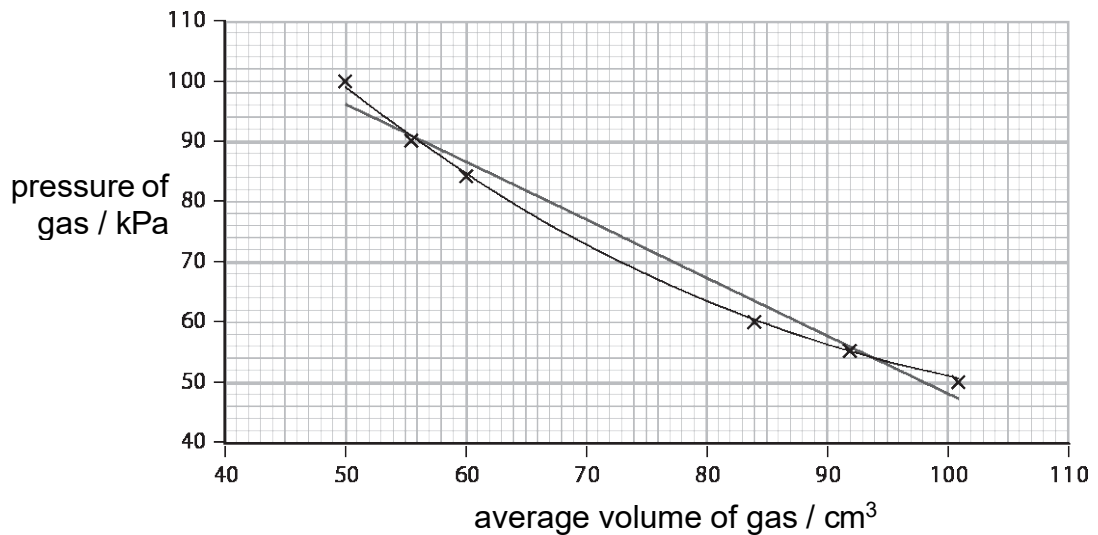


Figure 10.3

(i) Describe the relationship between the two variables.

[1]

.....

(ii) Suggest two ways in which the student can improve her data, such that she can decide whether to draw a straight line or a curve.[2]

.....

.....

.....

- (iii) State what is meant by “accuracy” in her results, and suggest a source of error that could lead to inaccuracy in her results apart from the variable suggested in (c). [2]

.....

.....

.....

- e. This experiment verifies a law describing the relationship between pressure and volume of a gas.

State what is meant by a scientific “law”. [1]

.....

.....

Total [10]

- 10** Three strips of potato, X, Y and Z, were placed in 0 %, 10 % and 20 % sucrose solutions separately. After 20 minutes, the length of each strip was measured. The results are recorded as shown in Table 2.1.

Table 2.1

strip	initial length / mm	final length / mm
X	50	53
Y	50	49
Z	50	47

- (a) Identify the aim of the experiment.
- (b) (i) Identify the sucrose solution in which strip X was placed in.

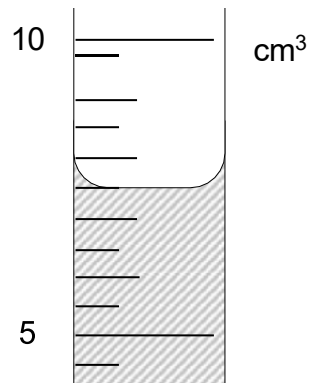
..... [1]

- (ii) Explain your answer to b(i).

..... [3]

[Total: 5m]

- 11 The diagram shows the water level in a measuring cylinder when water is added to it.



- a. What is the volume of the water added?

volume = _____ [1]

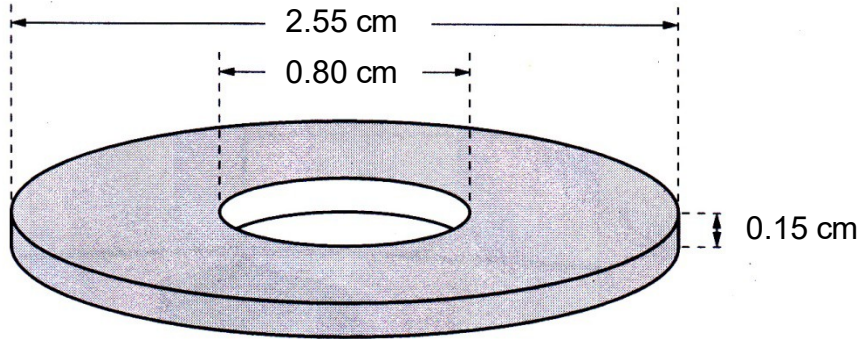
- b. Express the volume of the water in S.I. units.

volume (in S.I. units) = _____ [2]

[Total: 3m]

12 The diagram below shows a large metal washer.

The washer is 0.15 cm thick and the internal and external diameters are marked on the diagram.



a. Nicole uses a ruler to measure the internal diameter of the washer.

i. Describe an issue Nicole will face when she measures the internal diameter of the washer.

.....
 [1]

ii. Suggest a more appropriate instrument for Nicole to use to determine the internal diameter of the washer.

..... [1]

b. (i) Calculate the volume of metal in the washer.

[2]
 volume = _____

(ii) Using an electronic balance, the mass of the washer was found to be 5.2 g.

Calculate the density of the metal.

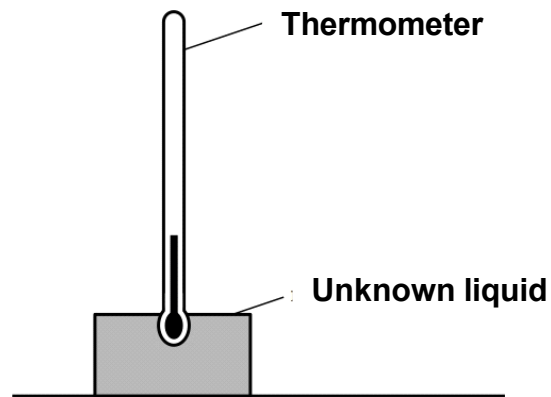
density = _____ [2]

[Total: 6m]

13 A student is measuring the melting point of an unknown liquid using a mercury thermometer without calibration.

The lengths of the mercury column indicating the ice point and steam point are found to be 3.2 cm and 36.1 cm respectively.

She leaves a block of frozen unknown liquid on the table and measures the length of a mercury column while the block melts.



The length of the mercury column indicating the melting point of the unknown liquid is 0.2 cm.

Calculate the melting point of the unknown liquid.

[2]

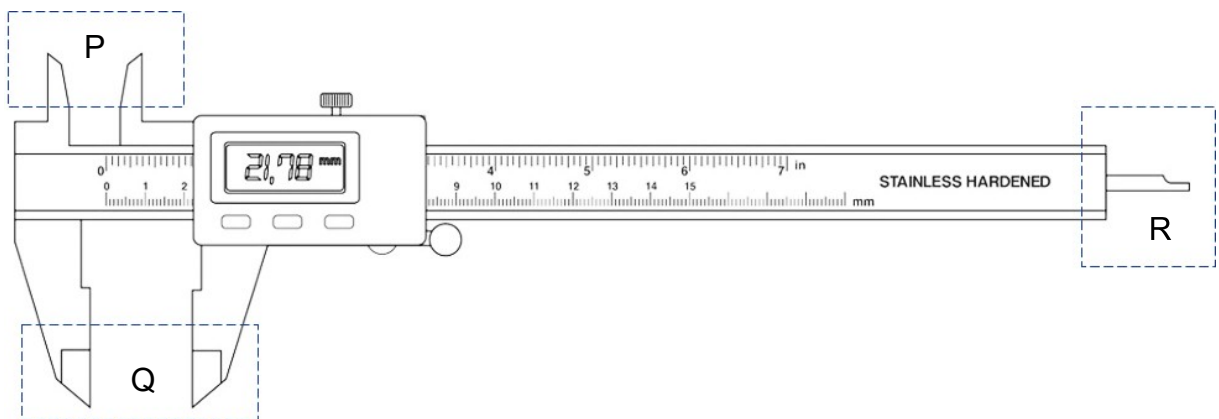
[Total: 2m]

ANSWERS FOR PHYSICAL PROPERTY MCQ

- 1 Which of the following has the best definition of a *hypothesis*?
- A** It is a possible explanation for experimental observations.
- B** It is the clarification of issues through questioning.
- C** It is the conclusion drawn from the experiment.
- D** It is the exploring of all alternatives and possibilities over the obvious choice.
- 2 A student decides to design an experiment to compare how sunlight affects the growth of a plant.

Which variable is essential to ensure a fair test?

- A** conduct the experiment in the laboratory
- B** **measure** the time taken for the plant to grow
- C** supply equal amount of nutrients to each plant
- D** use the same measurements of the plant pot
- 3 The diagram below shows parts (P, Q, R) of a digital caliper.



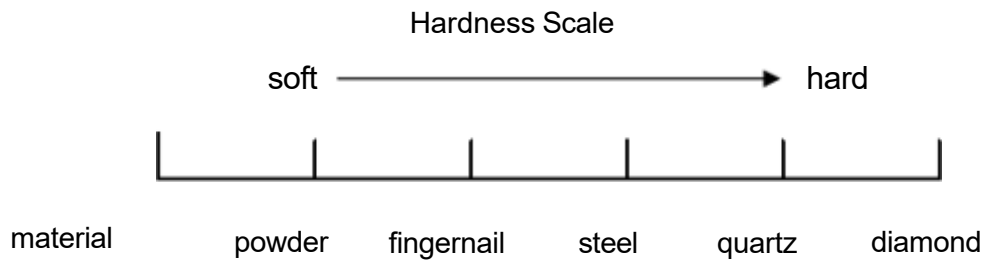
Which part(s) of the caliper should be used to measure the internal diameter of a test-tube?

- A** P only
- B** Q only
- C** R only
- D** P and Q
- 4 Which pair of apparatus should be used to determine the volume of an irregular solid?
- A** burette and displacement can
- B** burette and pipette
- C** displacement can and measuring cylinder
- D** pipette and measuring cylinder

5 Which of the following about a luminous and non-luminous Bunsen flame is **incorrect**?

	luminous flame	non-luminous flame
A	air hole is closed	air hole is opened
B	orange in colour	blue in colour
C	produces soot	does not produce soot
D	hotter	less hot

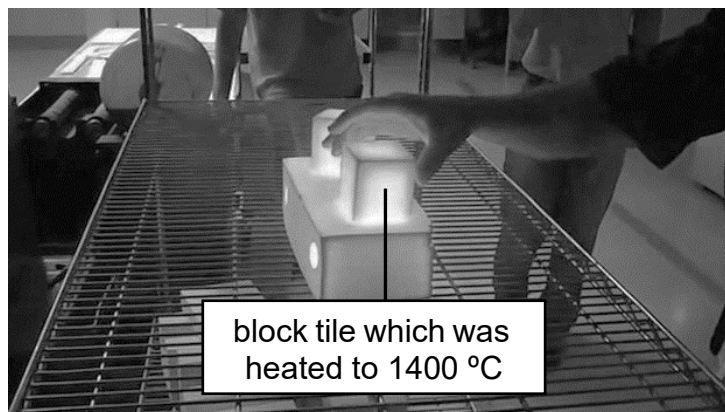
6 The hardness scale for 5 different materials is shown below:



Which statement is true?

- A Fingernail is able to scratch quartz but not steel.
- B Powder is able to scratch diamond.
- C Quartz is only able to scratch one substance.
- D Steel is unable to scratch quartz.**

- 7 Based upon the scientific method, in what order are the initial stages of a scientific investigation carried out?
- A hypothesis → experiment → question → observe
- B hypothesis → question → experiment → observe
- C observe → question → hypothesis → experiment**
- D observe → hypothesis → question → experiment
- 8 Which of the following **cannot** be investigated by conducting scientific experiments?
- A How the motion of distant stars and planets affect an individual's personality.**
- B How the density of an object affects whether it will sink or float in water.
- C How the surface area of an object affects the rate at which it falls to the ground.
- D How adding fertiliser to soil affects the height of plants as they grow.
- 9 Which of the following statements about Science are true?
- I Scientists know everything about the natural world with absolute certainty.
- II Scientists may explain the same phenomena in slightly different ways.
- III Scientists may change their minds in the light of new evidence.
- IV Scientists can obtain a wide range of different results for the same experiment.
- A I and II only
- B II and III only
- C II and IV only
- D III and IV only**
- 10 The diagram below shows a person touching a block tile which was heated to 1400 °C.



Which property of the block allows the person to touch the block and not get hurt?

- A poor hardness
- B high melting point**
- C good electrical conductivity
- D poor thermal conductivity

11 Which of the following substances is a **liquid** at room temperature (25°C)?

Substance	melting point / °C	boiling point / °C
A	35	79
B	-56	73
C	-134	12
D	-138	1

Ans : B

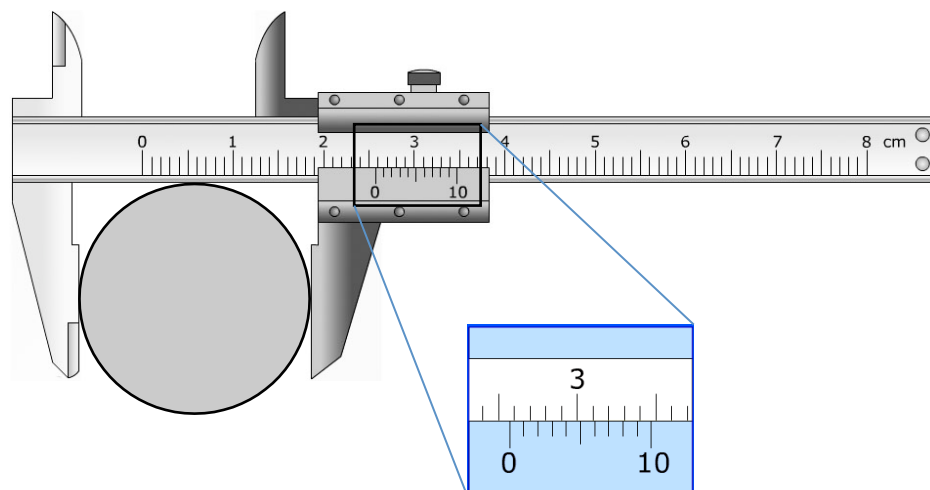
12 Which of the following physical properties describes the ability to withstand scratches and to scratch another material?

- A elasticity
- B flexibility
- C hardness**
- D strength

13 To avoid making errors when taking measurements, which of the following needs to be checked on the instrument first before taking reading?

- A it is calibrated in SI base unit
- B it has half divisions
- C there is no parallax error
- D there is no zero error**

14 A pair of vernier calipers calibrated in centimetre is used to take a measurement of a circular object as shown below.

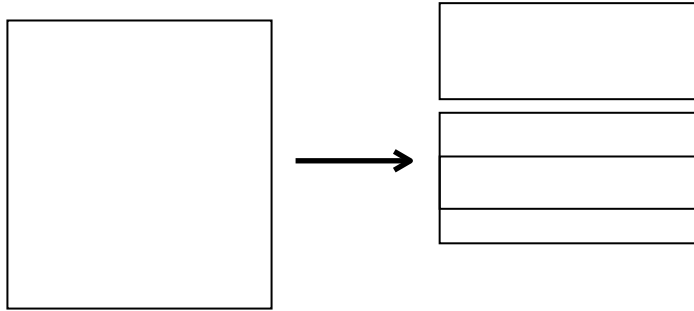


What is the reading on the vernier calipers?

- A 2.57 cm**
- B 3.07 cm
- C 3.20 cm
- D 3.27 cm

- 15 Which of the following is a correct definition of classification?
- A Classification is the method of dividing things into groups according to different properties.
 - B Classification is the method of dividing things into groups according to the same property.**
 - C Classification is the method of dividing things into groups according to similar properties.
 - D Classification is the method of dividing things into groups according to two similar properties.

- 16 A large wooden plank is cut into three equal pieces.



Which statement about the wooden planks' densities is correct?

- A The density of each individual plank is half that of the original piece.
 - B The density of each individual plank is the same as the original piece.**
 - C The density of each individual plank is three times larger than the original piece.
 - D The density of each individual plank is three times smaller than the original piece.
- 17 In mining fields, drills are used to remove rock formation blocking access to the valuable ores beneath. The intense drilling also generates high amount of frictional heat.

Which combination of physical properties is of highest concern when considering the material used to make the drill?

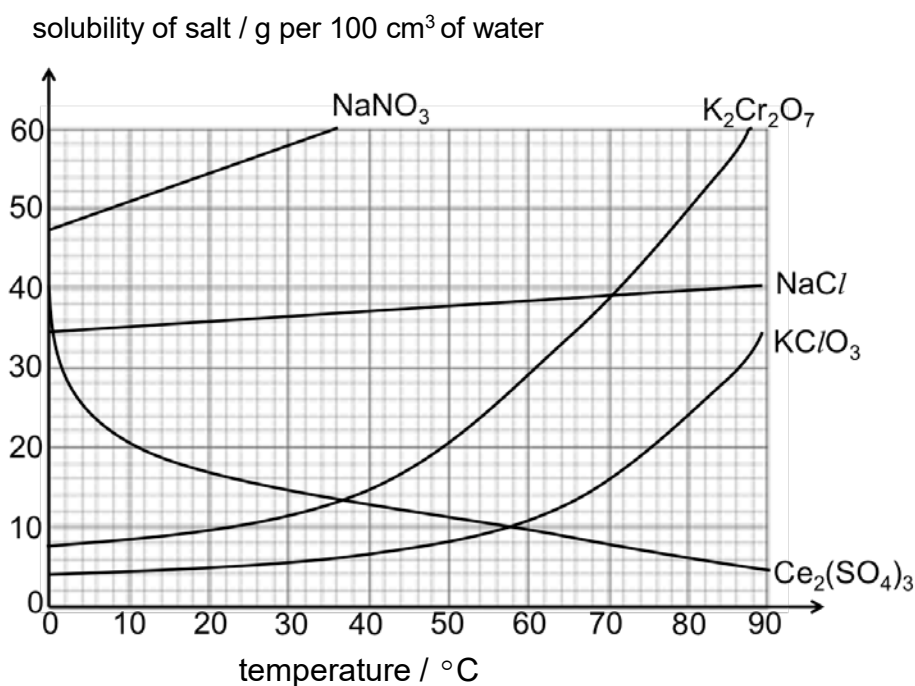
- A hardness, electrical conductivity, boiling point
- B hardness, strength, melting point**
- C strength, electrical conductivity, thermal conductivity
- D strength, melting point, transparency

- 18 A student has extracted an essential oil from the lemongrass plant found in Singapore using water.

The mixture in water is cloudy, but it becomes clear after the student adds and shakes the mixture with ethanol (alcohol).

What does this observation show?

- A Ethanol is insoluble in water.
 - B The essential oil is soluble in water.
 - C The essential oil is soluble in ethanol but insoluble in water.**
 - D The essential oil and ethanol are both soluble in water.
- 19 The following graph shows how the solubility of nine salts in water varies with temperature.



Which statement is correct?

- A KClO₃ has a higher solubility in water than NaCl.
- B NaCl and K₂Cr₂O₇ have the same solubility at approximately 70 °C.**
- C The solubility of NaNO₃ is 50 g per 100 cm³ of water at 30 °C.
- D The solubility of many salts decreases rapidly with temperature.

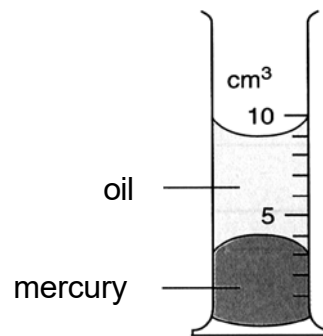
20 Which of the following shows the correct S.I. unit for all three physical quantities?

	Physical Quantities		
	Mass	Time	Temperature
A	gram	second	celsius
B	kilogram	hour	celsius
C	kilogram	second	kelvin
D	milligram	minute	kelvin

21 The Vernier calipers can be used to measure all of the following items **except** the

- A depth of a test tube
- B external diameter of a ping pong ball
- C internal diameter of a water hose
- D length of your Science file**

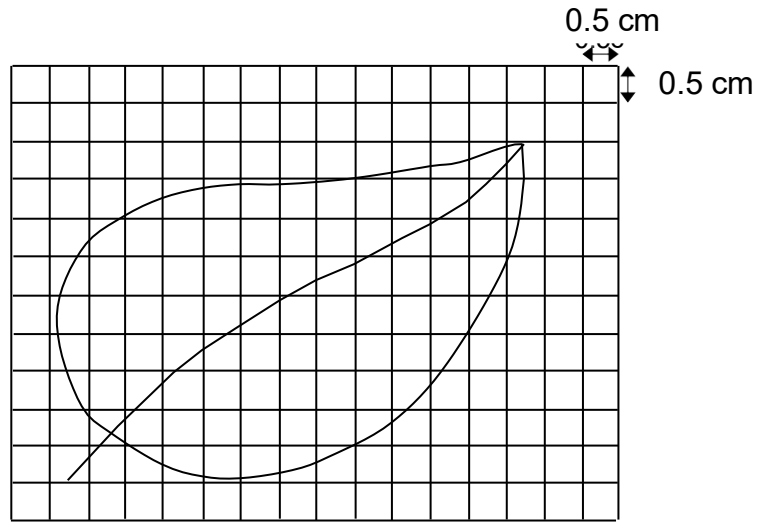
22 The diagram shows a measuring cylinder containing some oil and mercury.



What is the volume of oil in the measuring cylinder?

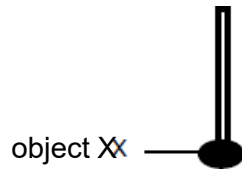
- A** 4 cm³
- B** 5 cm³
- C** 9 cm³
- D** 10 cm³

23 What is the approximate area of the leaf as shown in the diagram below?

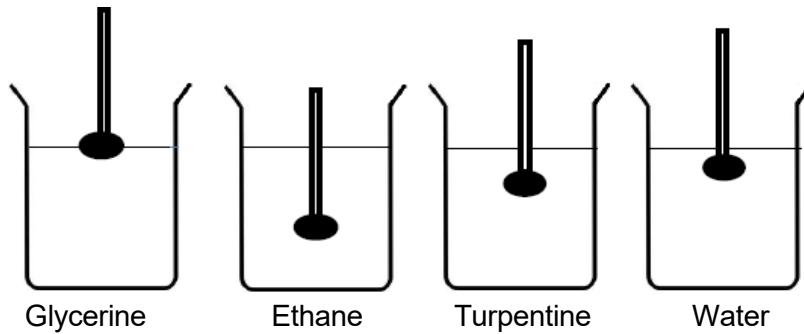


- A** 16 cm² **B** 20 cm²
C 36 cm² **D** 80 cm²

24 A straw loaded with object X is shown below.



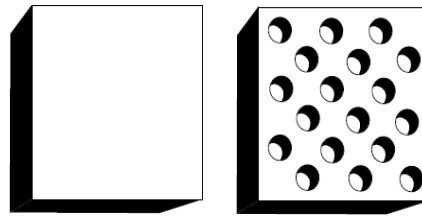
Its relative positions when placed in various liquids are shown in the diagram below.



Which liquid has the lowest density?

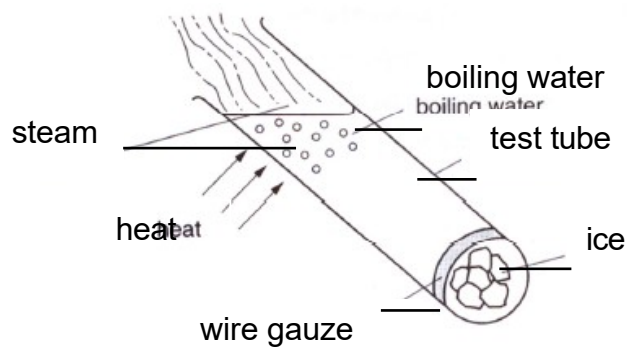
- A** Ethane **B** Glycerine
C Turpentine **D** Water

- 25 May had a thin, solid piece of material. She placed the material in water and it floated. She took the material out and punched holes all the way through it.



What will May observe when she puts the material with holes back in the water?

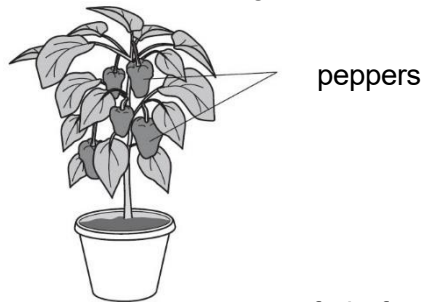
- A It will sink.
 - B It will barely float.
 - C It will float the same as before.**
 - D It will neither sink nor float. It will bob up and down in the water.
- 26 Boiling water and ice can exist at the same time in a test tube. What does this experiment show?



- A Convection occurs in water.
- B Wire gauze is a good reflector of heat.
- C Wire gauze has a higher density than water.
- D Water does not conduct heat well.**

ANSWER FOR PHYSICAL PROPERTY STRUCTURED QUESTIONS

- 1 Avani wants to investigate the effect of adding fertiliser to pepper plant.



Avani conducts her investigation adding one of six fertilisers (A to F) that contain different percentage by mass of nitrogen, phosphorus and potassium to the soil of six different plant pots.

Table 1.1 shows the results of Avani’s experiment.

Table 1.1

fertiliser	percentage by mass in each fertiliser			number of peppers produced
	nitrogen	phosphorus	potassium	
A	20	40	40	98
B	30	30	40	78
C	30	35	35	76
D	30	40	30	77
E	40	30	30	56
F	50	25	25	42

- (a) Suggest a suitable hypothesis for the above experiment.

Fertilisers that contain higher percentage by mass of nitrogen will produce less peppers/decrease pepper growth

At least one IV (nitrogen/potassium/phosphate) **and DV** (number of peppers/growth of peppers).

(or any other acceptable statements)

Reject: Fertiliser A produces the most number of peppers

Reject: Change in fertiliser affects change in number of peppers produced

[1]

- (b) To make it a fair test, Avani keeps the following factors constant:

- size of pot
- amount and type of soil
- size and type of plant at the start
- amount of fertilizer

State two other factors that she must keep constant.

same of light/light intensity/sunlight; same temperature;
same volume of water/watering; grown for same time
number of peppers/leaves in the beginning of experiment (any two)

[1]

- (c) Her friend Min Dee says that Avani should grow more pots of pepper plants using each fertiliser. Explain the reason for Min Dee's suggestion.

to make Avani's results more reliable; allow Avani to calculate an average Reject:
accuracy; consistency; fair

[1]

2 In the lab, some apparatus can be used to measure or hold liquids.

- a. Explain why the conical flask is **not** suitable to measure precise volumes of liquids.

There are only markings every 25 or 50 cm³. (accept large intervals)

[1]

- b. The conical flask is used to handle hydrogen peroxide, H₂O₂, which has the following symbols.



Name all 3 symbols and suggest an appropriate safety precaution when handling hydrogen peroxide.

Oxidising, Irritant/health hazard, Corrosive (Reject: flammable) – [1]

Wear gloves/goggles while handling (ecf. keep away from fire) – [1]

- c. Fig 3.1 shows apparatus X, that is used to determine the volume of liquids. Fig 3.2 shows a close-up of the liquid level.

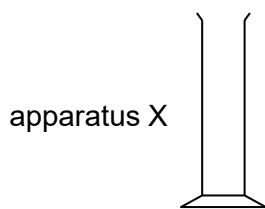


Fig 3.1

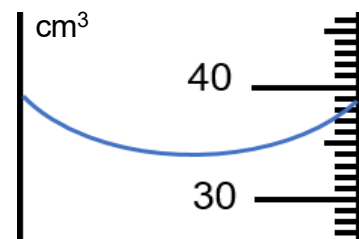


Fig 3.2

- (i) Name apparatus X.
[1]

Measuring cylinder.....

- (ii) State the volume of liquid in X.
[[1]

34.0 cm³.....

- (iii) Suggest a precaution during the measurement process to ensure that the volume reading is accurate.

Ensure that the reading is done at eye level. Leave cylinder on table and read at eye level.

Accept: Read marking perpendicular/parallel to marking/apparatus

Accept: Read lower meniscus

[1]

- 3 Alice carried out an experiment for a school project. She filled one petri dish with 50 cm³ of a high sugar soda drink, a second petri dish with 30 cm³ of a low sugar soda drink, and a third petri dish with 40 cm³ of distilled water. A summary of her experiment is given in **Fig. 1.1**.

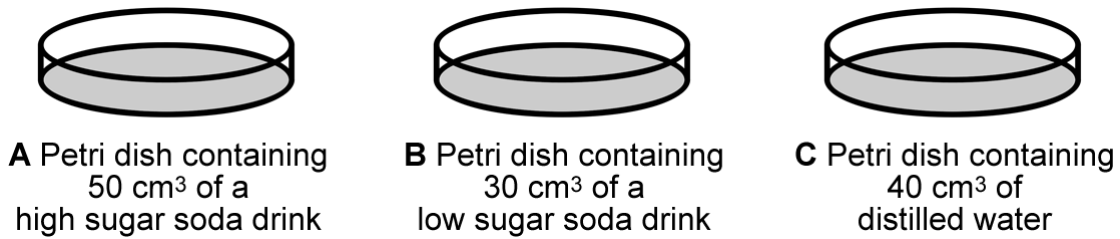


Fig. 1.1

Alice conducted her experiment once. She left the three petri dishes in her school's ecology garden and counted the number of honeybees that visited each solution over periods of 10 minutes for 1 hour. Her results are given in **Table 1.1**.

time / minutes	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
number of honeybees that visited the high sugar soda drink A	7	9	12	8	10	11
number of honeybees that visited the low sugar soda drink B	2	4	4	3	5	3
number of honeybees that visited the distilled water C	0	0	0	1	0	1

Table 1.1

- (d) State Alice's hypothesis for this experiment. [1]

Honeybees are **attracted to** / prefer **high sugar soda drinks** compared to low sugar soda drinks.

- (e) State Alice's control for this experiment. [1]

Distilled water / Petri Dish C.

- (c) Identify **two** errors that Alice made in the design of this experiment. [2]

The experiment was only conducted once. [1]

Alice used different volumes of the liquids / solutions. [1]

- 4 (a) Define *density*.
[1]

Density is defined as the mass per unit volume of a substance.

- (b) Fig. 1.1 shows the cross-sectional view of a submarine.

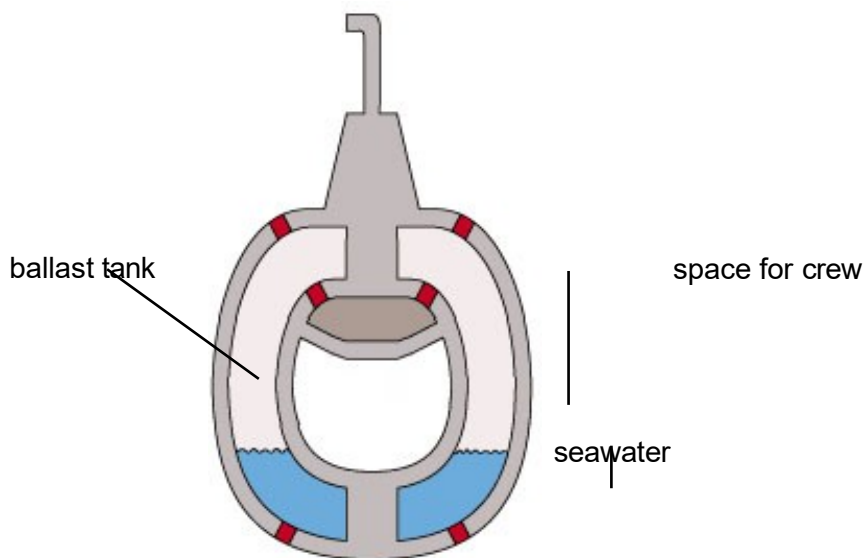


Fig. 1.1

A submarine is able to rise or sink in the sea by releasing seawater from its ballast tanks and taking in seawater into its ballast tanks respectively.

- (i) Explain how the submarine is able to float and sink in the sea by releasing seawater and taking in seawater.
[2]

When the submarine takes in/releases seawater, its mass increases/decreases but its volume remains the same.
Its density increases/decreases to become greater/less than that of seawater, causing it to sink/rise.

- (ii) A submarine has a volume of 2730 m³ and mass of 210 000 kg when it carries a full load of crew and equipment but without any seawater in its ballast tanks.

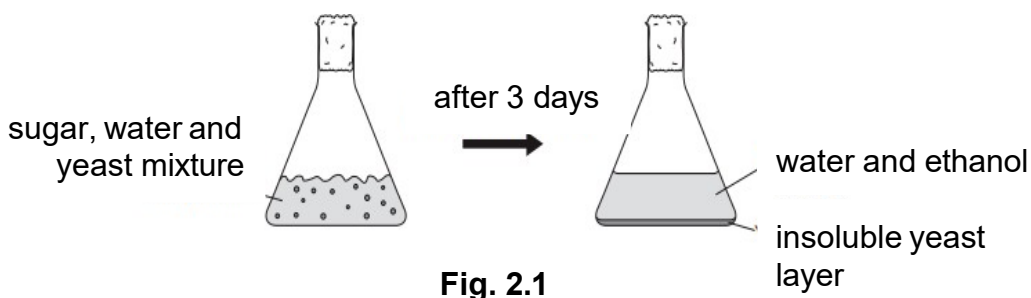
If the density of seawater is 1030 kg / m³, calculate the mass of seawater that is required to be taken into the ballast tanks for it to sink in the sea.

[2]

For it to sink, density of submarine = 1030 kg / m³
 $\text{mass} / 2700 \text{ m}^3 = 1030 \text{ kg} / \text{m}^3$
 $\text{mass} = 1030 \text{ kg} / \text{m}^3 \times 2730 \text{ m}^3 = 2811900 \text{ kg}$ mass of seawater required
 $= 2811900 \text{ kg} - 210000 \text{ kg} = 2601900 \text{ kg}$

Total [5]

Fig. 2.1 below shows how ethanol is produced by fermentation in the laboratory. A sugar solution is mixed with yeast and the mixture is kept at a temperature of 37 °C for three days. After three days, a mixture of water, ethanol and yeast is obtained.



- (a) Ethanol has a chemical formula of C_2H_5OH . State the type of elements and the number of atoms per each type of element in ethanol.

[2]

2 Carbon atoms, 6 Hydrogen atoms, 1 oxygen atom

- (b) Describe the method(s) of separation that you will use in the laboratory to obtain a pure sample of ethanol from the mixture produced.

[2]

Filtration to remove insoluble yeast as residue

Fractional distillation to separate ethanol from water.

- (c) Describe a test that you would perform to ensure that the ethanol obtained in (a) is pure and the expected observation or results obtained if ethanol is pure.

[2]

Test the boiling point of ethanol;

If it boils at a fixed temperature; (78 °C), it is pure.

Total [6]

- 5 Emma bought a 50 g wooden cube from a store. The wooden cube is shown in Figure 1.1.



Figure 1.1

Source:

https://media.gettyimages.com/photos/wooden-cube-picture-id182837156?b=1&k=6&m=182837156&s=612x612&w=0&h=37Pf_oKsvl6BqVTFyv2na0Ws16ZG66GcfXppR4UeaOI=

Emma places this wooden cube on an electronic balance. The electronic balance reading is 49.5 g.

- (a) Emma feels that she was short-changed.

By examining the *precision* and *accuracy* of the reading of the mass of the wooden cube, explain if you agree with Emma.

[3]

The wooden cube is 1% less than the promised mass of 50 g. Thus, it is not very accurate. However, the precision of the promised mass is to the nearest whole number. Based on this, as $49.5 \text{ g} = 50 \text{ g}$ (nearest whole number), Emma is not short-changed.

- (b) Emma wants to find the density of the wooden block. Suggest what she must do to determine the density of the wooden block.

[3]

Measure the length of one side of the block by using a pair of Vernier calipers.

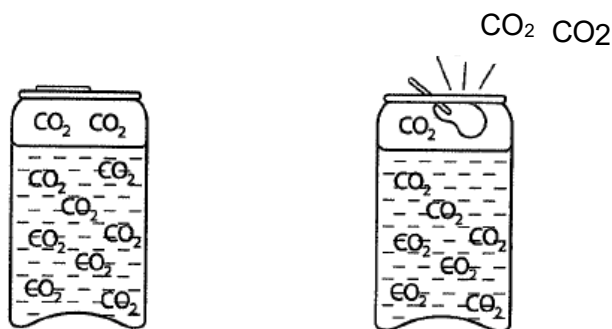
Calculate the volume of the cube by using $\text{volume} = (\text{length})^3$

Calculate the density of the block by using $\text{Density} = \text{Mass} / \text{Volume}$

Total [6]

- 6 The diagram below shows a carbonated drink containing sucrose ($C_{12}H_{22}O_{11}$) and dissolved carbon dioxide. The solubility of gases decreases with an increase in temperature.

Student 1 suggests that the carbonated drink is a solution while student 2 suggests that it is a suspension.



A drink can contains carbon dioxide dissolved in water under high pressure.

When the can is opened, the pressure is released and carbon dioxide leaves the water.

- (c) (i) Identify the solutes and the solvent present in the carbonated drink. [2]

Solutes: carbon dioxide and sucrose Solvent: water

- (ii) Deduce from the diagram the effect of pressure on the solubility of carbon dioxide in water. [1]

An increase in pressure causes more carbon dioxide to dissolve (and vice-versa)

- (iii) Suggest one method to cause the release of more carbon dioxide from an open can of carbonated drink. [1]

Warm the drink / add heat or thermal energy / increase the temperature of the drink;
Shake the can/ Stir the drink
Add solid particles e.g., mentos, sugar, salt etc.

- (d) (i) State one property of a solution and one property of a suspension. [2]

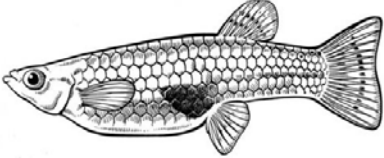

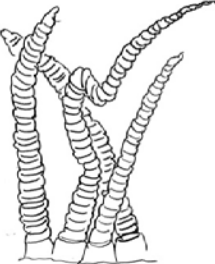
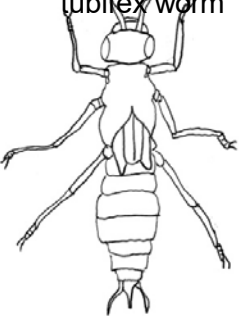
A solution is homogeneous / clear / does not scatter light;
A suspension is heterogeneous / cloudy / scatters light / particles will settle at the bottom.

- (ii) Explain whether student 1 or 2 was correct. [1]

Student 1, since sucrose and carbon dioxide are both soluble in water / a carbonated drink does not scatter light / no sediment collects at the bottom.

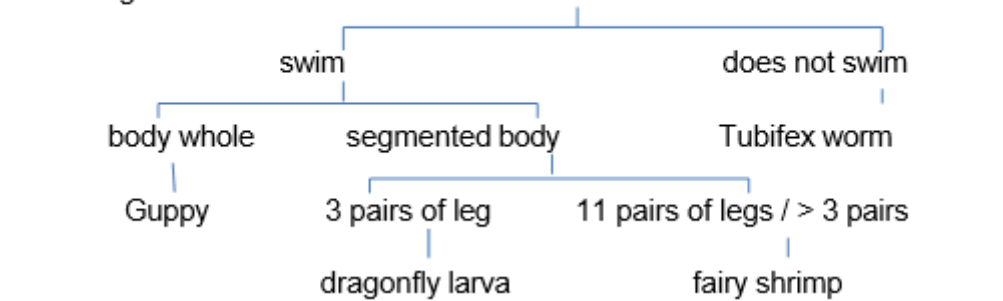
Total [7]

7 Table 4.1 shows some aquatic organisms that were found in a school pond.

aquatic animal	characteristics
 <p style="text-align: center;">guppy</p>	<ul style="list-style-type: none"> • swims in the water • whips tail to move • has fins
 <p style="text-align: center;">fairy shrimp</p>	<ul style="list-style-type: none"> • swims in the water • does not have fins • does not whip tail to move • segmented body parts
 <p style="text-align: center;">tubifex worm</p>	<ul style="list-style-type: none"> • 11 pairs of swimming legs • does not swim in the water • segmented body parts
 <p style="text-align: center;">dragonfly larva</p>	<ul style="list-style-type: none"> • swims in the water by jet propulsion especially when threatened • segmented body parts • 3 pairs of legs

- (e) Draw a dichotomous key, in the space given below, to classify the different organisms using the information provided in Table 4.1.
[4]

E.g.
Pond organisms



- (f) Guppies were added to the school pond to control the population of mosquito larvae and prevent the breeding of mosquitoes.

Guppies are not native to Singapore. Suggest two reasons why the introduction of guppies into local waterways such as reservoirs and freshwater rivers may be a threat to the native fish populations.

[2]

Competition for resources; (food/space)
Guppies may carry disease-causing bacteria that may harm native fish population.

Total [6]

- 8 An NYGH student uses the set-up below to investigate the pressure and volume inside a sealed gas syringe.

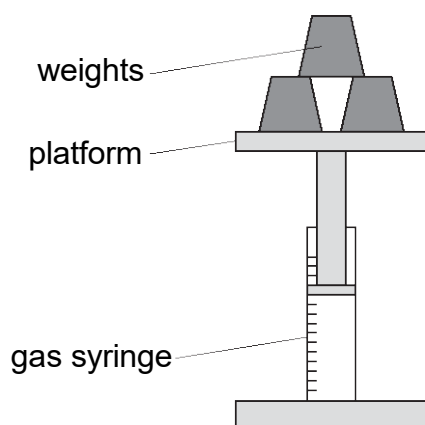


Figure 10.1

She records readings of the volume of gas as she increases the pressure from 50 kPa to 100 kPa by loading more weights onto the platform (loading).

She records readings of the volume of gas as she decreases the pressure from 100 kPa to 50 kPa by removing weights from the platform (unloading).

Table 10.2 below shows her results.

Table 10.2

pressure / kPa	volume of gas / cm ³		
	loading	unloading	average
50	101	101	101
55	90	x	92
60	85	83	84
84	60	60	60
90	56	54	55
100	50	50	50

- a. State the dependent variable in this investigation.
[1]

volume of air

- b. Suggest a possible value for x in the table.
[1]

94

- c. Suggest one variable that the student needs to control or keep constant to make the investigation a fair test, and explain how, if not kept constant, it could affect her results.
[2]

temperature of gas

If not kept constant, the volume of the gas could **increase due to an increase in temperature**, instead of because of change in pressure.

- d. Figure 10.3 below shows her results plotted on a graph, together with a best fit line.

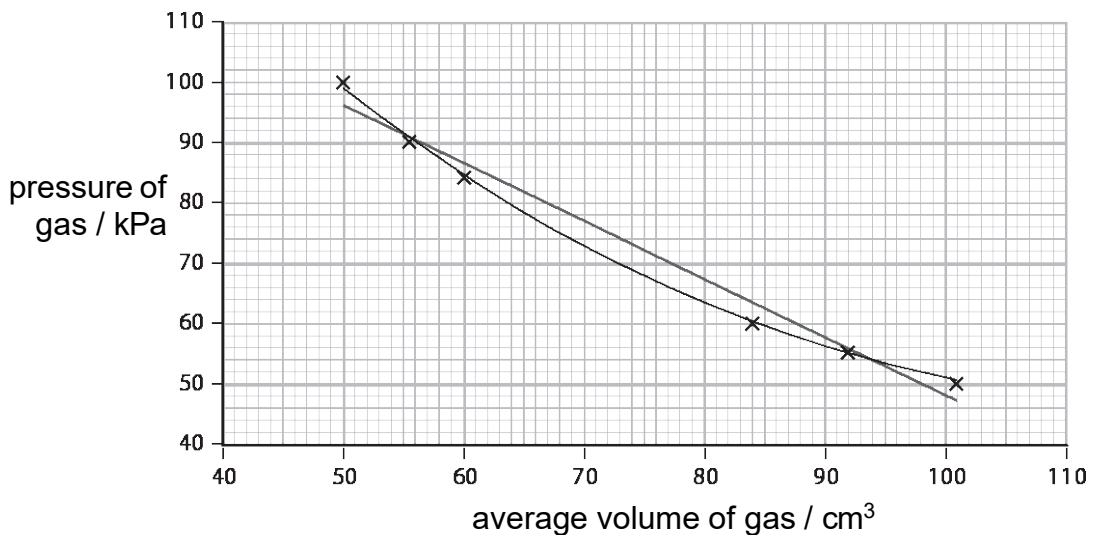


Figure 10.3

- (i) Describe the relationship between the two variables.
[1]

As pressure increases, volume decreases (or vice-versa) / inverse relationship.

- (ii) Suggest two ways in which the student can improve her data, such that she can decide whether to draw a straight line or a curve.
[2]

[2]

Take more readings to fill the gap in the middle between 60 and 84 kPa;
Take more readings to increase the range of the data / to check the consistency of her data.

- (iii) State what is meant by “accuracy” in her results, and suggest a source of error that could lead to inaccuracy in her results apart from the variable suggested in (c).

[2]

Accuracy is how close a measurement is to the true value. Some gas leaked out / Parallax error

- e. This experiment verifies a law describing the relationship between pressure and volume of a gas.

State what is meant by a scientific “law”.

[1]

A relationship that has been verified or observed many times.

Total [10]

- 9 Three strips of potato, X, Y and Z, were placed in 0 %, 10 % and 20 % sucrose solutions separately. After 20 minutes, the length of each strip was measured. The results are recorded as shown in Table 2.1.

Table 2.1

strip	initial length / mm	final length / mm
X	50	53
Y	50	49
Z	50	47

- (a) Identify the aim of the experiment.

To investigate how the length of the potato strip changes in different sucrose concentration; OR

To investigate / determine the concentration of sucrose/water potential in the potato strip;

- (b) (i) Identify the sucrose solution in which strip X was placed in.

0 % sucrose solution OR water; [1]

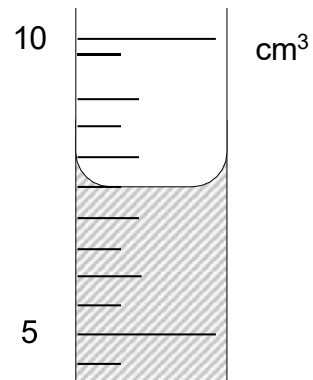
- (ii) Explain your answer to b(i).

Potato strip X showed an increase in length/increased by 3 mm; (due to) a net movement of water molecules into the potato strip by osmosis; causing the cells to expand/become turgid; (this indicates) water potential of external sucrose solution should be higher than that of the potato strip; water potential of 0 % sucrose solution is the highest amongst the three solutions; max 3

..... [3]

[Total: 5m]

10 The diagram shows the water level in a measuring cylinder when water is added to it.



a What is the volume of the water added?

$$\text{volume} = 7.50 \text{ cm}^3 \quad [1]$$

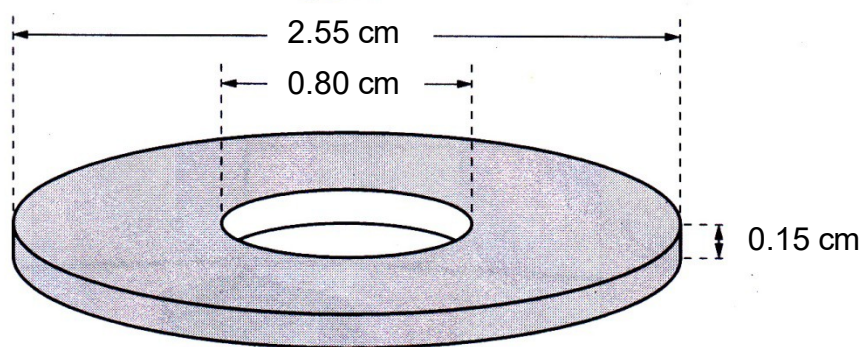
b Express the volume of the water in S.I. units.

$$\begin{aligned} & 7.50 \div 100 \div 100 \div 100 \\ & = 7.5 \times 10^{-6} \text{ m}^3 \text{ or } 0.0000075 \text{ m}^3 \end{aligned}$$

[2]

[Total: 3m]

- 11 The diagram below shows a large metal washer.
The washer is 0.15 cm thick and the internal and external diameters are marked on the diagram.



- a Nicole uses a ruler to measure the internal diameter of the washer.
- i. Describe an issue Nicole will face when she measures the internal diameter of the washer.

Nicole will not be able to measure the internal diameter to the correct precision as the ruler has a precision of only 0.1 cm
OR
Nicole will find it difficult to accurately locate the internal diameter of the washer.

[1]

- ii. Suggest a more appropriate instrument for Nicole to use to determine the internal diameter of the washer.

Vernier calipers [1]

- b (i) Calculate the volume of metal in the washer.

$$\begin{aligned} \text{volume} &= \left(\pi \left(\frac{2.55 \text{ cm}}{2} \right)^2 - \pi \left(\frac{0.8 \text{ cm}}{2} \right)^2 \right) (0.15 \text{ cm}) \\ &= 0.691 \text{ cm}^3 \text{ (3 s.f.)} \end{aligned}$$

[2]

- (ii) Using an electronic balance, the mass of the washer was found to be 5.2 g.

Calculate the density of the metal.

$$\begin{aligned} \text{density} &= \frac{5.2 \text{ g}}{0.691 \text{ cm}^3} \\ &= 7.53 \text{ g / cm}^3 \text{ (3 s.f.)} \end{aligned}$$

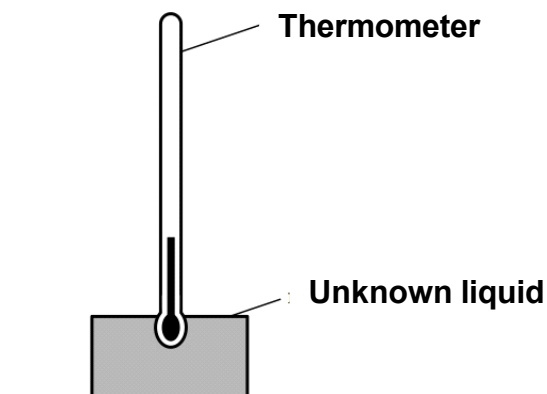
[2]

[Total: 6m]

12 A student is measuring the melting point of an unknown liquid using a mercury thermometer without calibration.

The lengths of the mercury column indicating the ice point and steam point are found to be 3.2 cm and 36.1 cm respectively.

She leaves a block of frozen unknown liquid on the table and measures the length of a mercury column while the block melts.



The length of the mercury column indicating the melting point of the unknown liquid is 0.2 cm.

Calculate the melting point of the unknown liquid.

$$(36.1 - 3.2) / 100 = (3.2 - 0.2) / (0 - x) \quad x = -9.12 \text{ } ^\circ\text{C}$$

[2]

[Total: 2m]