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PAPER



Practice
Questions



ICAS

International
Competitions
and Assessments
for Schools

DO NOT OPEN THIS BOOKLET UNTIL INSTRUCTED.

STUDENT'S NAME:

Read the instructions on the **ANSWER SHEET** and fill in your **NAME, SCHOOL** and **OTHER INFORMATION**.

Use a 2B or B pencil.

Do **NOT** use a pen.

Rub out any mistakes completely.

You **MUST** record your answers on the **ANSWER SHEET**.

SCIENCE

Mark only **ONE** answer for each question.

Your score will be the number of correct answers.

Marks are **NOT** deducted for incorrect answers.

Use the information provided to choose the **BEST** answer from the four possible options.

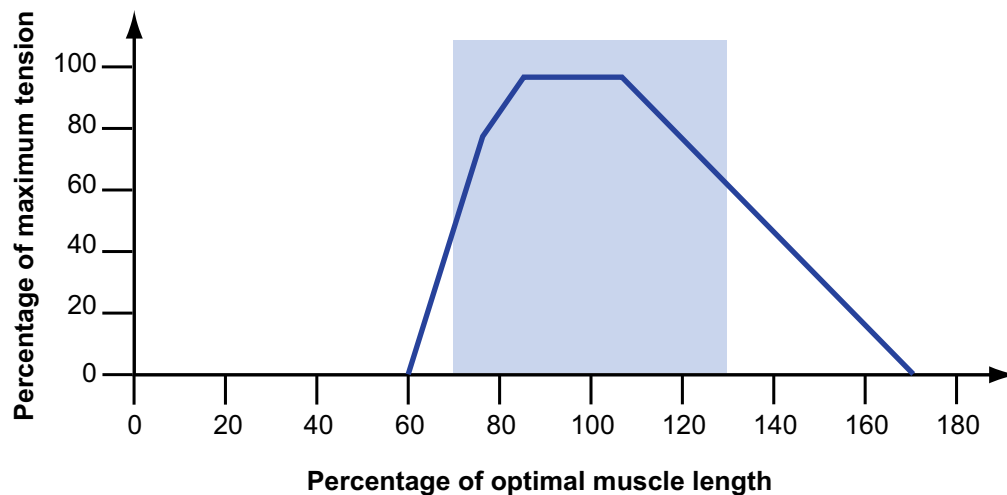
On your **ANSWER SHEET** fill in the oval that matches your answer.

You may use a calculator and a ruler.

Educational
Assessment

For questions 1 and 2 use the information below.

The graph shows the relationship between muscle fibre length and tension. The shaded bar indicates the range of muscle lengths that can occur in the body without the muscles detaching from the bones.



1. Over what percentage of optimal length can a muscle vary without detaching from the bones?

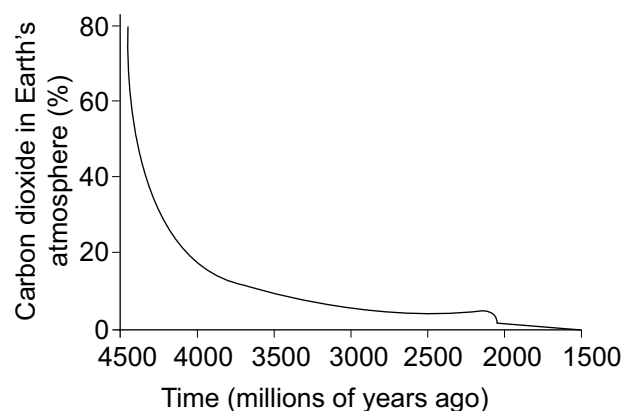
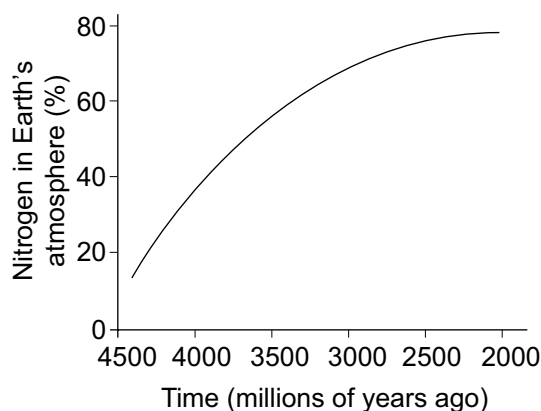
- (A) 40–60% (B) 60–170% (C) 70–130% (D) 80–140%

2. Which option best summarises the information in the graph?

The tension developed by a muscle fibre when it is stimulated

- (A) increases as the length of the fibre increases from shorter-than-optimal to optimal length, then decreases as the length exceeds optimal.
 (B) increases as the length of the fibre increases from shorter-than-optimal length, then continues to increase as the length exceeds optimal.
 (C) decreases as the length of the fibre increases from shorter-than-optimal to optimal length, then decreases again as the length exceeds optimal.
 (D) decreases as the length of the fibre increases from shorter-than-optimal to optimal length, then increases again as the length exceeds optimal.

3. The two graphs below show what scientists believe were the concentrations of nitrogen and carbon dioxide in the atmosphere between 4500 million and 2000 million years ago.



There was a time in history when carbon dioxide and nitrogen were present in equal percentages in the atmosphere.

At what time did this occur?

4. Some molecules are mirror images of each other. They cannot be rotated or moved so that one molecule can be superimposed on the other.

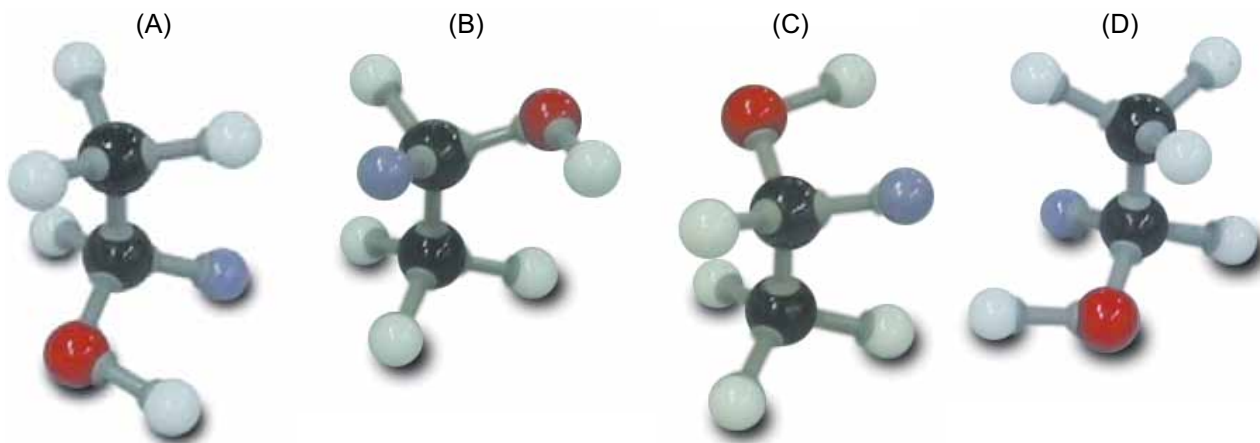
The models of molecules shown are mirror images of each other.



Here is a model of a molecule of 1-iodoethanol.



Which model of a molecule below is a mirror image of the one above?



For questions 5 and 6 use the information below.

In forensic science, blood alcohol content is tested at the time of sampling and, if challenged, from a stored sample.

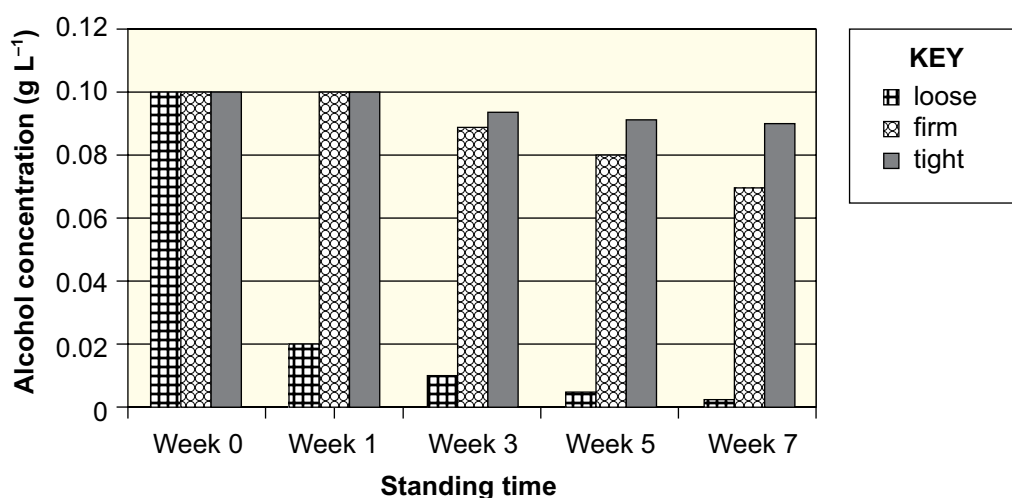
A student wanted to know how the tightness of the lid of a screw-topped container affected the loss of alcohol over time. He assumed alcohol behaved the same way in blood and water.

He partially filled three containers with equal quantities of 0.1 g L^{-1} alcohol solution. He then tightened the lids as follows.

- loose lid - tighten until resistance is experienced then turn lid back 1 mm.
- firm lid - tighten until resistance is just experienced.
- tight lid - tighten until resistance is just experienced then turn a further 1 mm forward.

The solutions were then stored in a storage cabinet at 30°C for a number of weeks.

His results are shown in the graph.

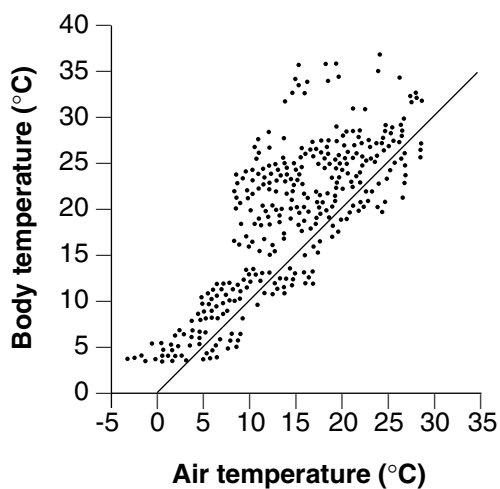
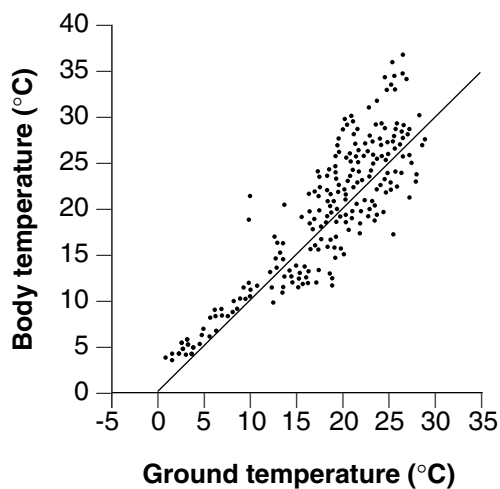


5. By how many grams per litre has the concentration dropped after three weeks in the container with the tight lid?
- (A) 0.005
(B) 0.01
(C) 0.09
(D) 0.095
6. Which hypothesis best applies to this experiment?
- (A) Blood reacts with alcohol over time.
(B) Blood kept in sealed containers should not be used in court.
(C) Changes in blood alcohol concentration are due to lid tightness.
(D) Changes in temperature affect blood alcohol concentration.

For questions 7 and 8 use the information below.

A frog's body temperature varies with its surroundings.

These two graphs compare the body temperatures of some frogs with the temperature of their surroundings.



7. Each dot represents the measured values taken for each individual frog.

The straight line on each graph is called the isothermal line.

What does it represent?

- (A) the dividing line separating the frogs into two equal groups
- (B) the line joining points where body temperature equals surrounding temperature
- (C) the ratio of average body temperature to surrounding temperature
- (D) the average body temperature of frogs at various surrounding temperatures

8. A student drew the following inferences:

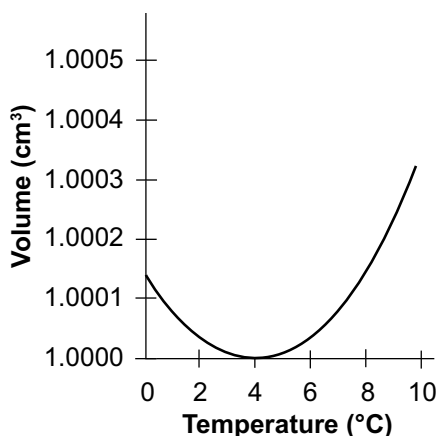
- I More than 50% of frogs have a body temperature higher than the air temperature.
- II A frog's body temperature increases as the temperature of its surroundings increases.
- III The air temperature is lower than ground temperature.

Which inference(s) is/are supported by the graphs?

- (A) I only
- (B) II only
- (C) I and II only
- (D) I, II, and III

9. The density of any substance is given by the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$



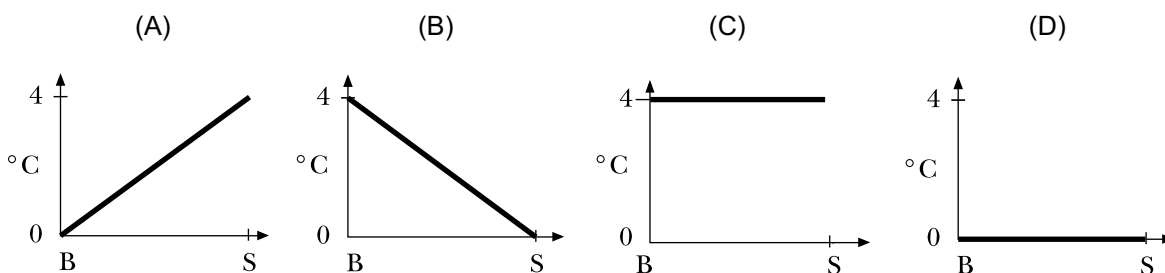
KEY
B = bottom
S = surface

The graph shows the volume of water in the temperature range from 0 to 10 °C.

When a pond cools, water from the surface sinks to the bottom because of its greater density.

As the temperature of the air above the water drops below 0 °C, the surface of the water freezes. The temperature of the ice formed stays at 0 °C as more water freezes.

Which of the graphs below shows the temperature at different depths in a pond of water as the surface freezes over?



10. When a liquid in a mixture evaporates, any dissolved solids are left behind.

The Soxhlet extractor works very well to extract chlorophyll from leaves using a flammable solvent.

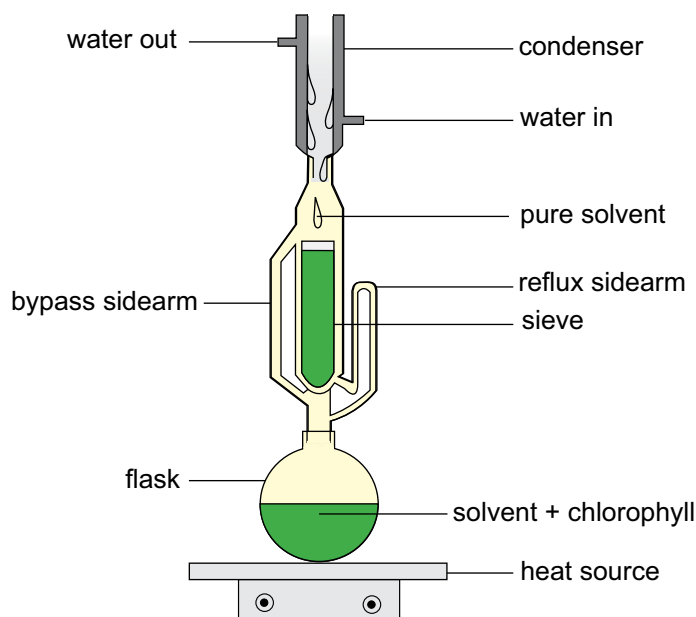
There are seven steps in the process.

1. The leaves are placed in a sieve.
2. The solvent evaporates and passes up through the bypass sidearm.
3. The solvent vapour enters the condenser.
4. The condenser liquefies the solvent which is now pure.
5. The liquid drops into the sieve and dissolves chlorophyll from the leaves.
6. When the liquid fills up to the top of the reflux sidearm, it is all siphoned back into the flask.
7. Solvent and chlorophyll collect in the flask.

The process repeats until the apparatus is switched off.

Which of the following statements explains why the Soxhlet extractor works so well?

- (A) Poisonous or flammable solvents can be used safely.
- (B) The extracting solvent is always near boiling point.
- (C) The solvent is constantly purified before re-use.



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The following year levels should sit THIS Paper:

Australia	Year 11
Brunei	Pre-University 1
Indonesia	Year 12
Malaysia	Form 5 & Lower 6
New Zealand	Year 12
Pacific	Year 11
Singapore	Secondary 4 & 5
South Africa	Grade 11



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- Rub out all mistakes completely.
- Print your details clearly in the boxes provided.
- Make sure you fill in only one oval in each column.

FIRST NAME						LAST NAME					
D	E	B	B	I	E	B	A	C	H		
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		
(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)		
(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)	(B)		
(C)	(C)	(C)	(C)	(C)	(C)	(C)	(C)	(C)	(C)		
(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)		

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☐ B ☐ B ☐ B ☐	☐ B ☐ B ☐ B ☐ B ☐ B ☐ B
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[illegible][illegible]

☐ Male ☐ Female



☐ Yes ☐ No

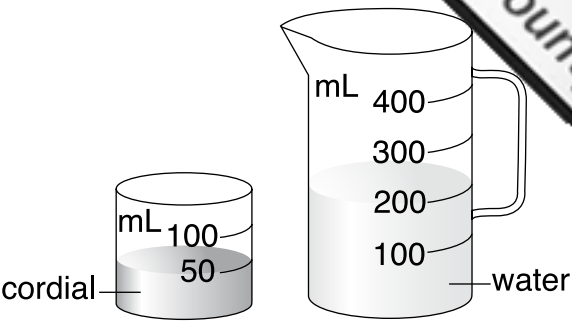
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2	2		2	2	2
3	3		3	3	3
	4		4	4	4
	5		5	5	5
	6		6	6	6

(A)	(K)
(B)	(L)
(C)	(M)
(D)	(N)
(E)	(O)
(F)	(P)
(G)	(Q)

TO ANSWER THE QUESTIONS

Example: Ari added cordial to water to make a jug of drink.
What will be the volume of the drink in the jug?

- (A) 50 mL
- (B) 150 mL
- (C) 200 mL
- (D) 250 mL



The answer is 250 mL, so you would fill in the oval (D), as shown.

(A) (B) (C) ☒



START

- 1 (A) (B) (C) (D)
- 2 (A) (B) (C) (D)
- 3 (A) (B) (C) (D)
- 4 (A) (B) (C) (D)
- 5 (A) (B) (C) (D)
- 6 (A) (B) (C) (D)
- 7 (A) (B) (C) (D)
- 8 (A) (B) (C) (D)
- 9 (A) (B) (C) (D)
- 10 (A) (B) (C) (D)

QUESTION	KEY	KEY REASONING	LEVEL OF DIFFICULTY
1	C	The shaded area extends from 70% to 130%.	
2	A	The graph shows that tension increases to 100% of optimal length and once this length is exceeded (>100%) tension starts to decrease.	Easy
3	C	If the graphs are plotted on the same set of axes, they will cross at approximately 4300 million years ago	Easy
4	D	A is identical to the original, so A is wrong. B is the same as A but it is has been flipped and rotated, so B is wrong. C is the same as B but has been further rotated, so C is wrong. Models A, B and C are all (1R)-1-iodoethanol. Compare D and the original; the blue atom is in a different position. D is a different chemical, and is called (1S)-1-iodoethanol. These are optical isomers.	Easy
5	A	The tight column in the graph shows that after three weeks the concentration in the tight lidded container dropped from 0.10 gL ⁻¹ to approximately 0.095 gL ⁻¹ which is a difference of 0.005 gL ⁻¹ . Please note that the question asks for the difference after three weeks and not seven weeks.	Medium/Hard
6	C	In the experiment the tightness of the lid has been altered (loose, firm, and tight) and change in alcohol concentration was measured.	Easy
7	B	From the graphs, the lines join points where body temperature equals the surrounding temperature.	Medium/Hard
8	C	Inference I can be drawn from the air-body temperature graph. Inference II can be drawn from both graphs. Inference III is not supported by these graphs as there is nothing to relate air temperature to ground temperature. Therefore option C is correct.	Medium
9	B	From the volume versus temperature graph, it can be seen that at 0 °C water is less dense than at 4 °C, which is the temperature where water has its maximum density. This means that the surface of the freezing pond is at 0 °C and the bottom is at 4 °C.	Hard
10	C	Because pure solvent is always entering the sieve dissolving any chlorophyll remaining in the leaves, the maximum amount of chlorophyll will be extracted from the leaves.	Hard

LEGEND

Level of difficulty refers to the expected level of difficulty for the question.

Easy more than 70% of candidates will choose the correct option.

Medium about 50–70% of candidates will choose the correct option.

Medium/Hard about 30–50% of candidates will choose the correct option.

Hard less than 30% of candidates will choose the correct option.