



PAPER H

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.

For questions 1 and 2 use the information below.

The key distinguishes between types of supernova according to the light they emit.

- | | |
|---|-----------------------------|
| 1. Does the spectrum contain hydrogen lines? | Yes, go to 4
No, go to 2 |
| 2. Does the spectrum contain silicon lines? | Yes, Type 1a
No, go to 3 |
| 3. Does the spectrum contain helium lines? | Yes, Type 1b
No, Type 1c |
| 4. Are helium lines dominant in the spectrum? | Yes, Type 2b
No, go to 5 |
| 5. Does the light curve decay linearly after peak brightness? | Yes, Type 2l
No, Type 2p |

1. A supernova shows both hydrogen and helium lines in its spectrum but the helium lines are much stronger than the hydrogen lines.

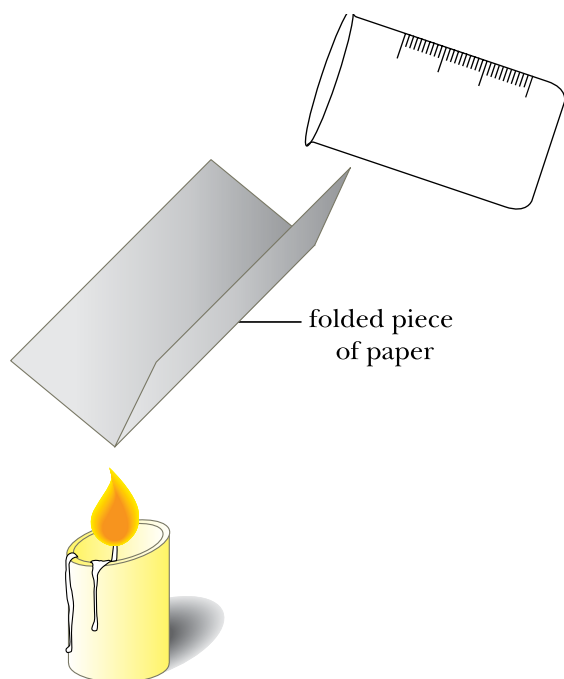
What type of supernova is it?

- (A) Type 1b
(B) Type 2b
(C) Type 2l
(D) Type 2p

2. Which description best fits the spectrum of a Type 1c supernova?

	Hydrogen lines	Helium lines	Silicon lines
(A)	present	absent	present
(B)	absent	absent	absent
(C)	present	present	present
(D)	absent	present	absent

3. A student takes a beaker of carbon dioxide gas at room temperature and tips it over the flame of a candle. She observes that the flame flickers and goes out.



The student made the following statements,

1. Carbon dioxide is heavier than air.
2. Carbon dioxide is a white gas.
3. Carbon dioxide extinguished the flame.
4. Carbon dioxide flowed down the folded paper.
5. Carbon dioxide is soluble in water.
6. Carbon dioxide does not support burning.

Which of these statements, are inferences supported by her observations?

- (A) 1 and 2 only
(B) 1, 4 and 6 only
(C) 1, 3, 4 and 6 only
(D) 2, 5 and 6 only

For questions 4 and 5 use the information below.

In general, solvents with the lowest boiling points release the most vapour into the air.

Flammable solvents can explode if a spark or flame is present.

The table gives facts about some commonly used solvents. The solvents listed can all enter the body through the lungs or skin or by swallowing.

Name	Boiling Point (°C)	Flammability	Toxicity	Solubility in water	Carcinogenic
acetone	57	high	low	very soluble	no
acetic acid	118	low	low	very soluble	no
carbon tetrachloride	77	nonflammable	medium	insoluble	probably
chloroform	61	nonflammable	high	insoluble	probably
ethanol	79	high	low	very soluble	yes, heavy drinkers only
ether	35	very high	medium	slightly soluble	no
methanol	65	high	high	very soluble	no

4. Bill believed that it didn't matter if the lids were left off bottles containing solvents.

Which solvent in the table is most likely to explode if a spark is present?

- (A) ethanol
(B) methanol
(C) chloroform
(D) ether

5. Methanol is used as a fuel in motor racing. People fuelling cars with methanol have been known to spill a large amount of fuel on themselves and catch alight.

Which option describes the best way of dealing with the fire and removing the methanol?

- (A) Allow the methanol to burn away then use the fire blanket.
(B) Spray the person with carbon tetrachloride.
(C) Use the person with cold water.

For questions 6 and 7 use the information below.

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

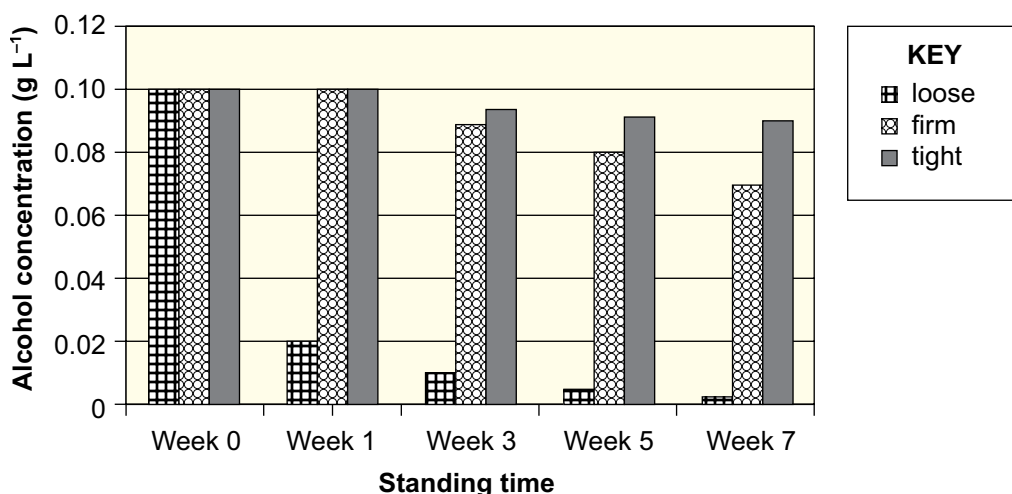
A student wanted to know how the tightness of the lid of a screw-topped container affected the loss of alcohol over time. He assumed alcohol behaved the same way in blood and water.

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.



6. 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
7. 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 8 and 9 use the information below.

Acceleration due to gravity is different on different planets. It depends on the mass and radius of the planet, as shown in the formula.

$$g = G \frac{m}{r^2}$$

KEY

g is the acceleration of an object due to the planet's gravity
G is a constant
m is the mass of the planet
r is the radius of the planet

8. Which imaginary planet would have an acceleration due to gravity equal to that of Earth?

Planet	Mass compared to Earth	Radius compared to Earth
(A)	four times larger	twice as large
(B)	half as large	half as large
(C)	one quarter as large	equal
(D)	twice as large	four times as large

9. The table below shows the mass and radius of some planets compared to Earth.

Planet	Mass compared to Earth	Radius compared to Earth
Mercury	0.055	0.38
Venus	0.86	0.95
Earth	1.0	1.0
Mars	0.11	0.53

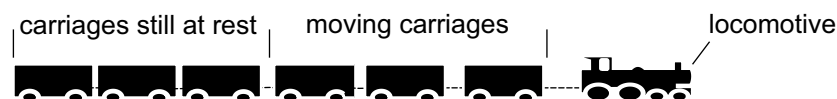
Which planet has the smallest acceleration due to gravity on the surface?

- (A) Mercury (B) Venus (C) Earth (D) Mars

10. The acceleration of a moving object can be expressed as the ratio

$$a = F/m$$

When a locomotive starts to pull a train, the identical carriages start to move one by one as shown.

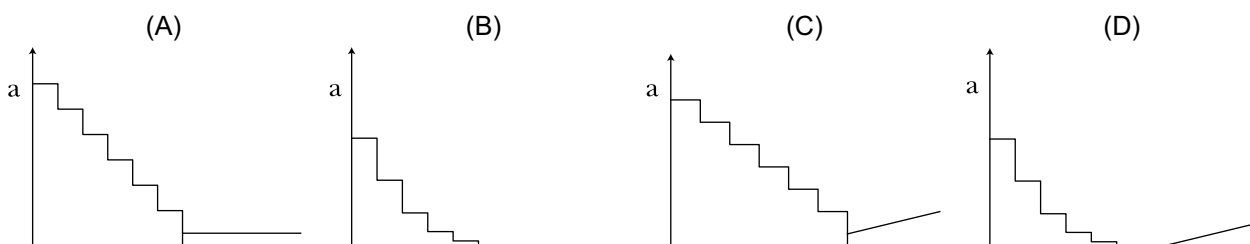


The locomotive in the diagram produces a constant force.

As time goes on, more carriages begin to move, one at a time.

The time t_0 is the moment when the last carriage starts moving.

Which of the graphs shows the acceleration of the train?



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The following year levels should sit THIS Paper:

Australia	Year 10
Brunei	Form 5
Hong Kong	Form 4
Indonesia	Year 11
Malaysia	Form 4
New Zealand	Year 11
Pacific	Year 10
Singapore	Secondary 3
South Africa	Grade 10



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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

DEBBIE

BACH

FIRST NAME

LAST NAME

C	H	A	N
O	O	O	O
A	A	A	A
B	B	B	B
C	C	C	C
D	D	D	D

A	I		B	E	N	G
O	O	O	O	O	O	O
A	A	A	A	A	A	A
B	B	B	B	B	B	B
C	C	C	C	C	C	C
D	D	D	D	D	D	D

FIRST NAME

LAST NAME

J	A	M	A	L		B	I	N		A	B	A	S
☐	☐	☐	☐	☐	☒	☐	☐	☐	☐	☒	☐	☐	☐
A	☒	A	☒	A	A	A	A	A	☒	A	☒	A	☐
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	☐

[illegible][illegible]

☐ Male ☐ Female



☐ Yes ☐ No

School name: _____

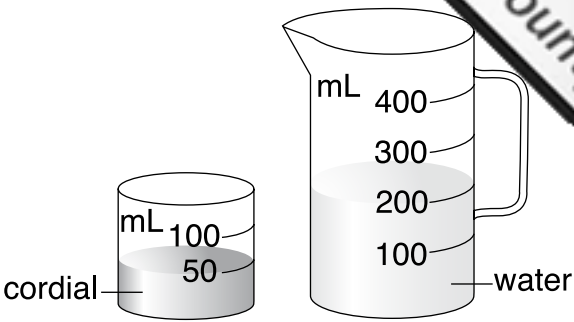
Day		Month		Year	
(0)	(0)	(0)	(0)	(0)	(0)
(1)	(1)	(1)	(1)	(1)	(1)
(2)	(2)		(2)	(2)	(2)
(3)	(3)		(3)	(3)	(3)
	(4)		(4)	(4)	(4)
	(5)		(5)	(5)	(5)
	(6)		(6)	(6)	(6)

(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) (D)



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	B	Start at the top, number 1. The supernova has hydrogen lines, go to number 4. It has dominant helium lines therefore it is type 2b.	Easy
2	B	In the key, work backwards from Type 1c, starting from number 3. The supernova does not have helium lines in number 3 (so C and D are wrong). At number 2, Type 1c didn't have silicon lines in order to get to number 3 (so A and C are wrong). Finally, at number 1, Type 1c didn't have hydrogen lines in order to get to number 2 (so A and C are wrong).	Easy
3	C	Since the flame went out, the following can be inferred: Carbon dioxide is heavier than air, Carbon dioxide extinguished the flame, Carbon dioxide flowed down the folded paper and Carbon dioxide does not support burning.	Easy
4	D	Solvents with the lowest boiling points release the most vapour into the air. Ether has the lowest boiling point and also has a very high flammability rating, so it is very likely to explode if a spark is present.	Easy
5	C	Methanol is water soluble, thus removing the highly toxic chemical, would cool the person's burns, thus reducing the severity of any burns, and cool the flames, thus putting out the fire. Carbon tetrachloride is a chemical that will probably cause cancers and is also moderately toxic so should not be used to spray on people. Therefore B is wrong. Methanol is highly toxic so wrapping the spilt methanol with the person in a fire blanket would not be recommended, so D is wrong.	Medium
6	A	The tight column in the graph shows that after three weeks the concentration in the tight lidded container dropped from 0.10 g L^{-1} to approximately 0.095 g L^{-1} which is a difference of 0.005 g L^{-1} . Please note that the question asks for the difference after three weeks and not seven weeks.	Hard
7	C	In the experiment the tightness of the lid has been altered (loose, firm, and tight) and change in alcohol concentration was measured.	Medium
8	A	Here it is important to realise that the effect of the radius is amplified, because it is squared, that is, if the radius is doubled (x2) then the planet's gravity is $\frac{1}{4}$ Earth's gravity, since $\frac{1}{(2r)^2} = \frac{1}{4r^2}$.	Medium/Hard
9	A	Calculations – compared to Earth's gravity, where $g_E \propto \left(\frac{m_E}{r_E^2}\right) = 980 \text{ cm / s}^2$: Mercury: $g = \frac{0.055 m_E}{(0.38 r_E)^2} = \frac{0.055}{0.38^2} \left(\frac{m_E}{r_E^2}\right) = 373 \text{ cm / s}^2$ Venus: $g = \frac{0.86 m_E}{(0.95 r_E)^2} = \frac{0.86}{0.95^2} \left(\frac{m_E}{r_E^2}\right) = 934 \text{ cm / s}^2$ Mars: $g = \frac{0.11 m_E}{(0.53 r_E)^2} = \frac{0.11}{0.53^2} \left(\frac{m_E}{r_E^2}\right) = 384 \text{ cm / s}^2$	Medium
10	B	For each carriage the locomotive will accelerate the train at a constant rate. When the next carriage is added the rate of acceleration will drop. Because the mass of the train increases as each carriage is added, the addition of each extra carriage increases the total mass by a smaller fraction, hence the acceleration is reduced by a smaller fraction. When all carriages are moving the acceleration is constant.	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.