



OUNDLE

School

EXAMINATION PAPER
13+ Academic Scholarship 2023

Science (Paper 1)

Time allowed: 1 hour

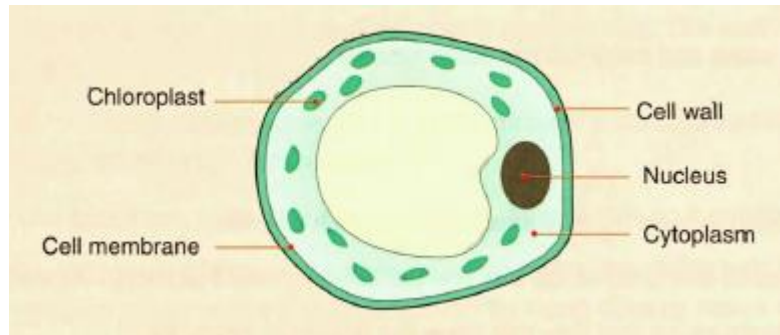
Name: _____

Instructions

- Write your name clearly in the space above.
- Answer on this paper.
- Calculators are allowed.
- Answer ALL the questions in all sections.
- You are expected to write clearly and accurately throughout each of your answers. You should leave some time towards the end of the examination to check your work carefully.
- The maximum number of marks for this paper is 58.

SECTION ONE: BIOLOGY [20 Marks]

1. The diagram below shows a plant cell.



a. The cell is a leaf cell. Give the name of the part which is present in this leaf but not present in root cells.

.....
[1 mark]

b. Give two parts of the cell, labelled on the diagram, which are not present in animal cells.

.....

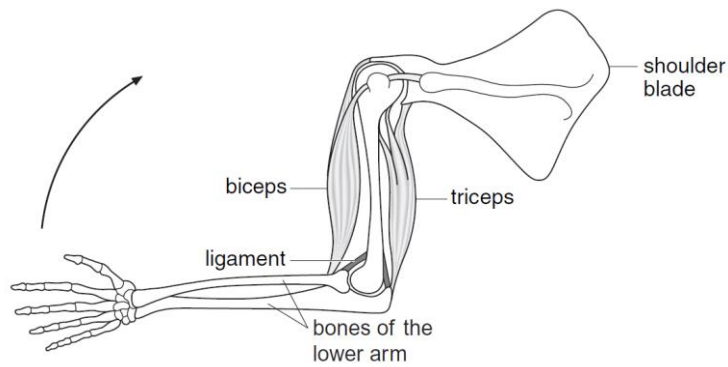
[2 marks]

c. The five parts of the cell labelled on the diagram have different functions. Complete the table below and write the name of the correct part of the cell next to its function. The first has been done for you.

Function	Part of the cell
A place where many chemical reactions take place.	Cytoplasm
Photosynthesis takes place here.	
It controls the cell's activities	
It helps to keep the shape of the cell.	
It controls the substances entering and leaving the cell.	

[3 marks]

2. The diagram below shows bones and muscles of the human arm.



The biceps and triceps are muscles that contract to move the bones of the lower arm.

a. What do the biceps and triceps do to move the arm in the direction shown by the arrow?

Tick the correct box.

- | | |
|--------------------------|---|
| <input type="checkbox"/> | The biceps and the triceps contract at the same time. |
| <input type="checkbox"/> | The biceps contracts and the triceps relaxes. |
| <input type="checkbox"/> | The biceps relaxes and the triceps contracts. |
| <input type="checkbox"/> | The biceps and the triceps relax at the same time |

[1 mark]

b. Ligaments hold bones together at a joint. Ligaments can stretch.

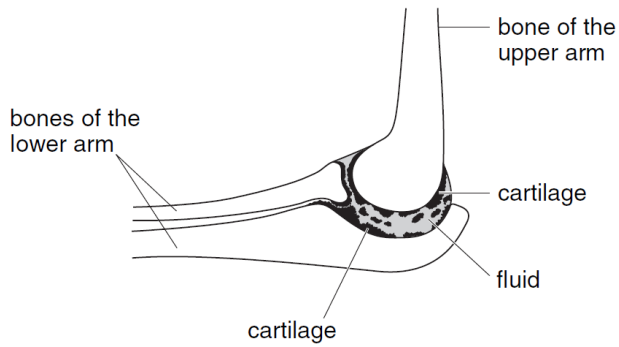
Why must ligaments be able to stretch?

.....
 ...

 ...

[1 mark]

c. The diagram below shows an elbow joint.



- i. The ends of the bones at a joint are covered by a layer of smooth material called cartilage.

There is also a fluid in the joint.

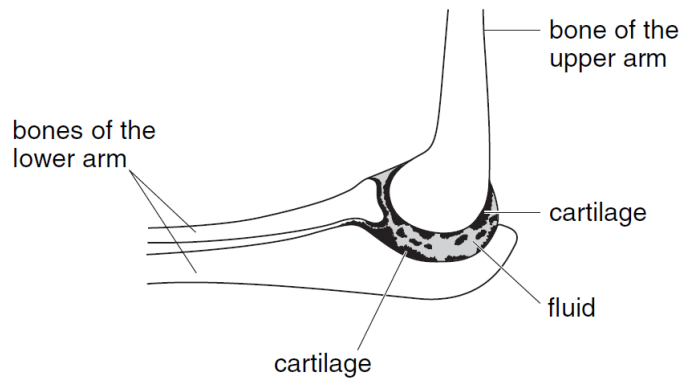
Why are cartilage and fluid needed in a joint?

.....

.....

[1 mark]

- ii. In the joint shown below, some of the cartilage has broken off.



Suggest **one** way this damage will affect the joint.

.....

.....

[1 mark]

3. This table shows the causes of death of cigarette smokers in Great Britain.

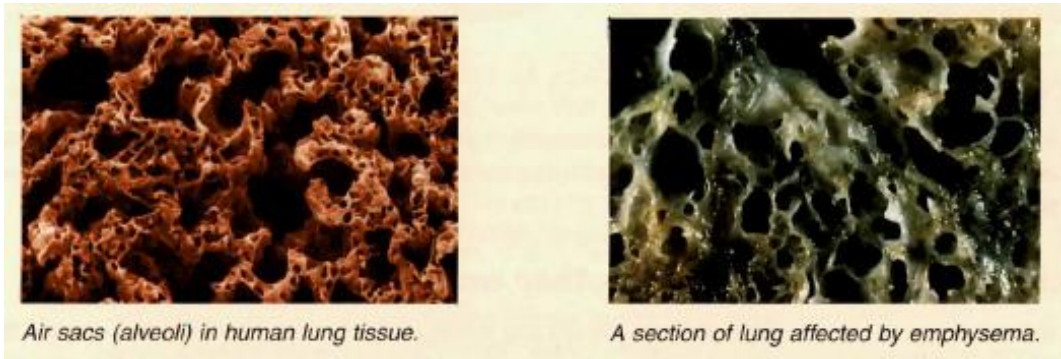
Cause of death	Percentage of deaths
Lung cancer	8
Bronchitis and emphysema	17
Circulatory diseases	20
Other causes (not related to smoking)	55

a. What percentage of smokers die from smoking-related diseases?

.....
.....

[2 marks]

b. Emphysema is a disease caused by smoking. The photograph on the left shows normal lung tissue and the photo on the right shows lung tissue from a person with emphysema.



i. Describe two differences between the normal lung tissue and lung tissue from a person with emphysema.

.....
.....
.....

[2 marks]

ii. Suggest how these differences affect the supply of oxygen to the blood in the person with emphysema?

.....
.....
.....

[2 marks]

iii. Name two other diseases caused by smoking, and say what the symptoms would be (i.e. how the patient would be affected).

.....

.....

.....

.....

.....

.....

[4 marks]

SECTION TWO: CHEMISTRY *[20 Marks]*

A Periodic Table is provided.

THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

Period

1	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 1 H Hydrogen 1 </div>																<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 4 He Helium 2 </div>															
2	7	9															11	12	14	16	19	20										
	Li Lithium 3	Be Beryllium 4															B Boron 5	C Carbon 6	N Nitrogen 7	O Oxygen 8	F Fluorine 9	Ne Neon 10										
3	23	24															27	28	31	32	35.5	40										
	Na Sodium 11	Mg Magnesium 12															Al Aluminium 13	Si Silicon 14	P Phosphorus 15	S Sulphur 16	Cl Chlorine 17	Ar Argon 18										
4	39	40															70	73	75	79	80	84										
	K Potassium 19	Ca Calcium 20															Ga Gallium 31	Ge Germanium 32	As Arsenic 33	Se Selenium 34	Br Bromine 35	Kr Krypton 36										
5	86	88															115	119	122	128	127	131										
	Rb Rubidium 37	Sr Strontium 38															In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54										
6	133	137															204	207	209	210	210	222										
	Cs Caesium 55	Ba Barium 56															Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86										
7	223	226	227																													
	Fr Francium 87	Ra Radium 88	Ac Actinium 89																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Relative atomic mass</td> <td style="width: 25%;">Symbol</td> <td style="width: 25%;">Name</td> <td style="width: 25%;">Atomic number</td> </tr> </table>																Relative atomic mass	Symbol	Name	Atomic number												
Relative atomic mass	Symbol	Name	Atomic number																													

Key

Relative atomic mass	Symbol	Name	Atomic number
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1. A student investigated the rate of reaction between marble chips and hydrochloric acid. **Figure 1** shows the apparatus the student used.

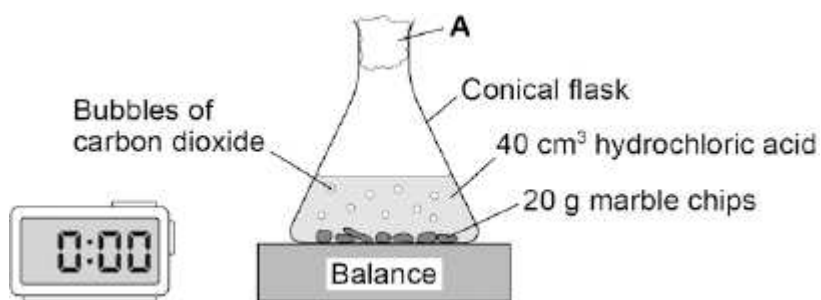


Figure 1

- a. What is **A**?

Tick **one** box.

cotton wool

limestone

poly(ethene)

rubber bung

[1 mark]

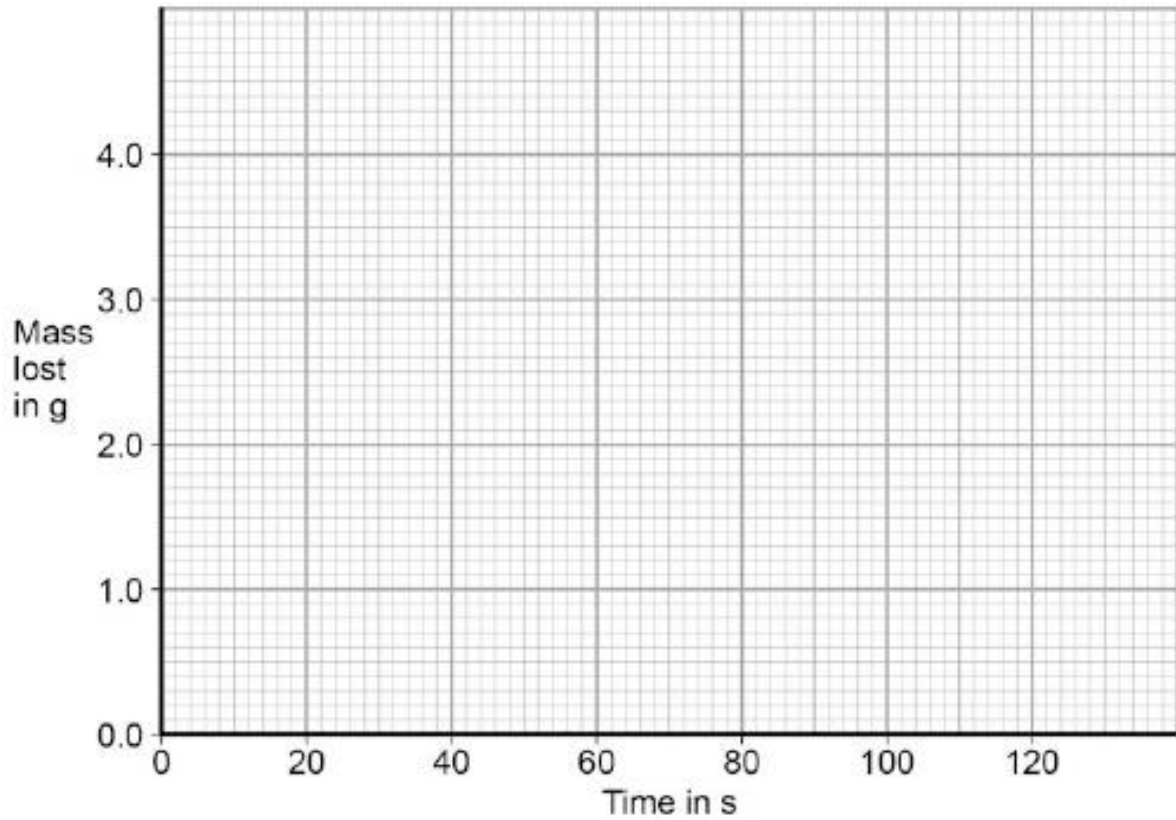
- b. **Table 1** shows the student's results for one investigation.

Table 1

Time in s	Mass lost in g
0	0.0
20	1.6
40	2.6
60	2.9
80	3.7
100	4.0
120	4.0

On the grid below:

- Plot these results
- Draw a line of best fit



[3 marks]

c. Circle the anomalous point.

Explain how this anomaly could have occurred.

.....
.....

[2 marks]

d. Use **your graph** to complete **Table 2**.

Table 2

Mass lost after 0.5 minutes	_____ g
Time taken to complete the reaction	_____ s

[2 marks]

e. The equation for the reaction is:



Explain why there is a loss in mass in this investigation.

.....

.....

.....

.....

[2 marks]

f. Another student investigated the rate of a different reaction.

Table 3 shows the results from the different reaction.

Table 3

Mass lost when the reaction was complete	9.85 g
Time taken to complete the reaction	2 minutes 30 seconds

Calculate the mean rate of the reaction using **Table 3** and the equation:

$$\text{mean rate of reaction} = \frac{\text{mass lost in g}}{\text{time taken in s}}$$

Give your answer to two decimal places.

Mean rate of reaction = _____ g / s

[2 marks]

- g. The student measured the change in mass of the reactants.

Describe another method, other than measuring the change in mass of the reactions, that the student could have used to find the rate of the reaction between marble chips and hydrochloric acid.

.....

.....

.....

.....

[2 marks]

2. The atoms of each element have different masses. These masses are given in the Periodic table.

- a. Use the table below to calculate the masses of each of the **compounds** in the equation for the reaction between magnesium and sulphuric acid given.

Atom	Mass (μ)
Mg	24
H	1
S	32
O	16

Equation:

	$\text{Mg (s) + H}_2\text{SO}_4\text{(aq) } \rightarrow \text{ MgSO}_4\text{(aq) + H}_2\text{(g)}$			
Mass (g)	24			2

[2 marks]

- b. Explain how these masses prove that mass is conserved in reactions.

.....

.....

[2 marks]

- c. So, if 24g of magnesium reacts with sulphuric acid, 2g of hydrogen is produced. Calculate the mass of MgSO_4 that is formed from 1.2g of magnesium.

.....

.....

[2 marks]

SECTION THREE: PHYSICS [18 Marks]

Questions 1 -9 are multiple choice. Clearly underline or circle the correct letter for each of the questions.

1.

A student measures the volume of a quantity of water.

Which apparatus is suitable?

- A** a balance
- B** a measuring cylinder
- C** a ruler
- D** a thermometer

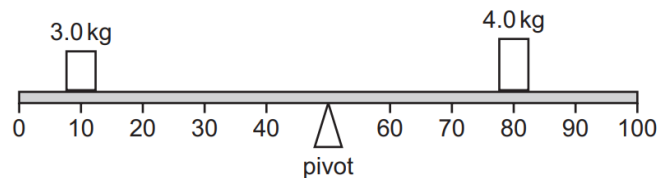
2.

Which substance in the table has the lowest density?

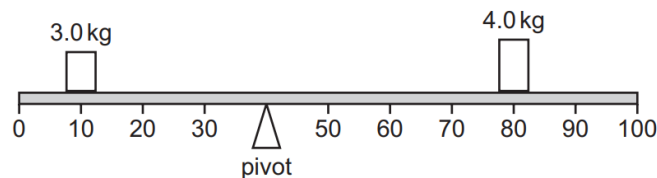
	substance	mass / g	volume / cm ³
A	nylon	1.2	1.0
B	cotton	1.5	1.0
C	olive oil	1.8	2.0
D	water	2.0	2.0

3.

A 100 cm beam balances as shown.



The pivot is moved 10 cm to the left.

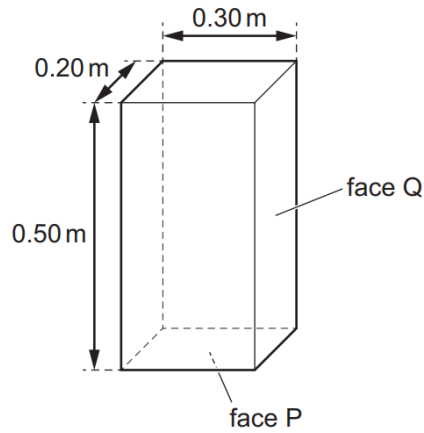


What will be the effect of this change on the anticlockwise and clockwise moments about the pivot?

	anticlockwise moment	clockwise moment
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

4.

The box shown has a weight of 15 N.



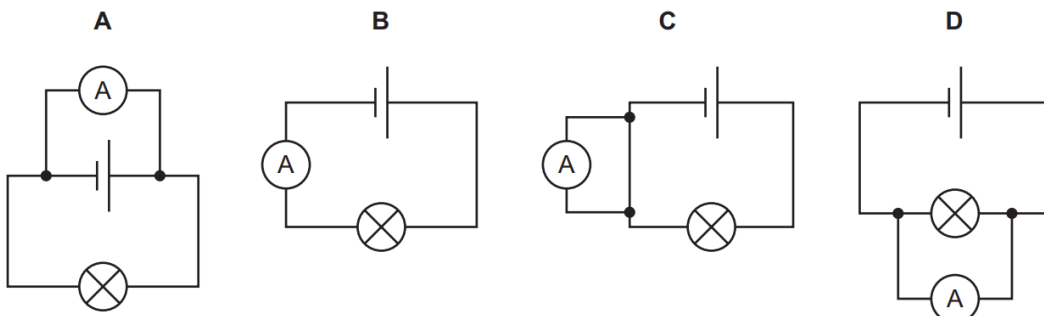
The box is resting on a horizontal surface with face P in contact with the surface.

What is the change in pressure on the surface if the box falls over onto face Q?

- A** $0.0040 \text{ m}^2/\text{N}$ **B** $0.0067 \text{ m}^2/\text{N}$ **C** 100 N/m^2 **D** 250 N/m^2

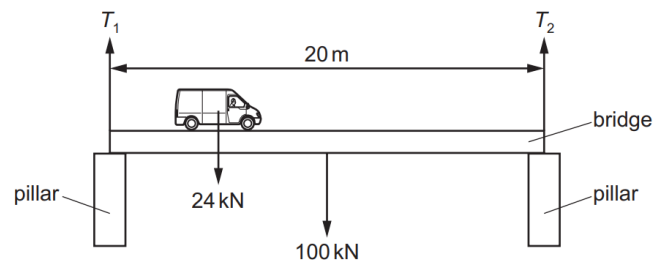
5.

In which circuit is the ammeter measuring the flow of charge through the lamp?



6.

A 20 m long, uniform bridge of weight 100 kN is supported at each end by pillars, as shown.



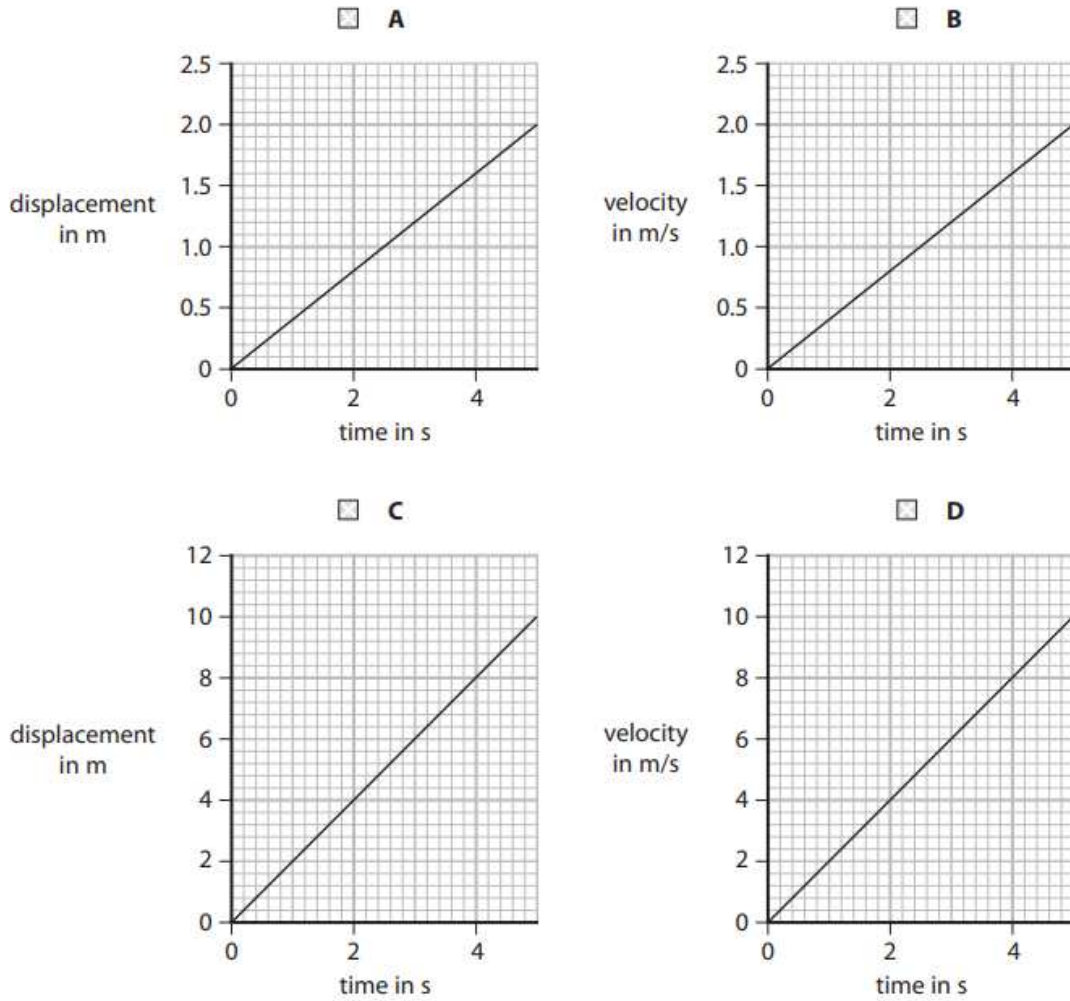
The pillars exert forces T_1 and T_2 on the ends of the bridge.

What are the values of T_1 and T_2 when a van of weight 24 kN is on the bridge, 5 m from the left-hand pillar?

	T_1/kN	T_2/kN
A	56	68
B	62	62
C	68	56
D	74	50

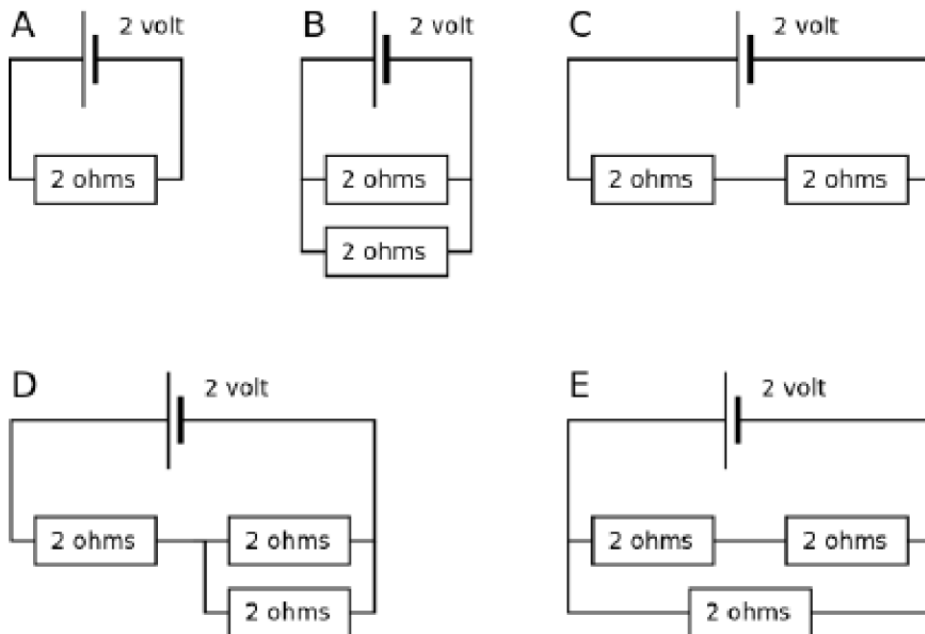
7.

(a) Which of these graphs represents an object moving with a constant velocity of 2 m/s?
(1)

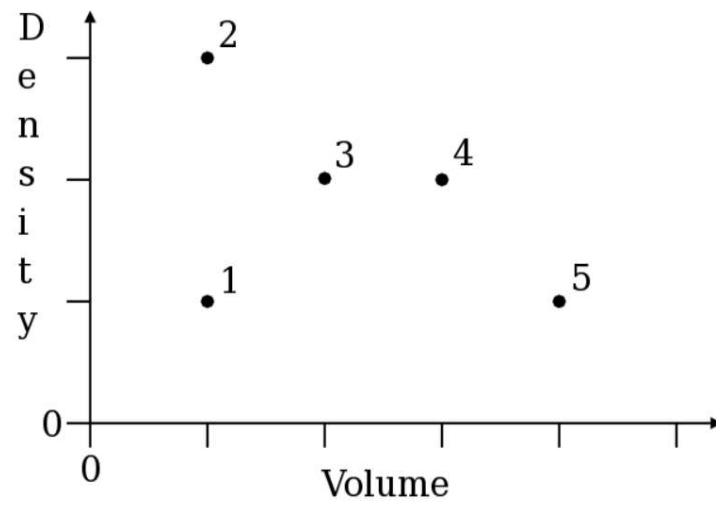


8. Consider the circuits shown below.

In which circuit is the current flowing through the cell the largest?



9. The density and volume of five samples of material are plotted on the graph as shown. Which two samples have the same mass?



- A. 3 & 5 B. 3 & 4 C. 1 & 2 D. 1 & 3 E. 1 & 5

10.

- a. Figure 1 shows some water in a tank.

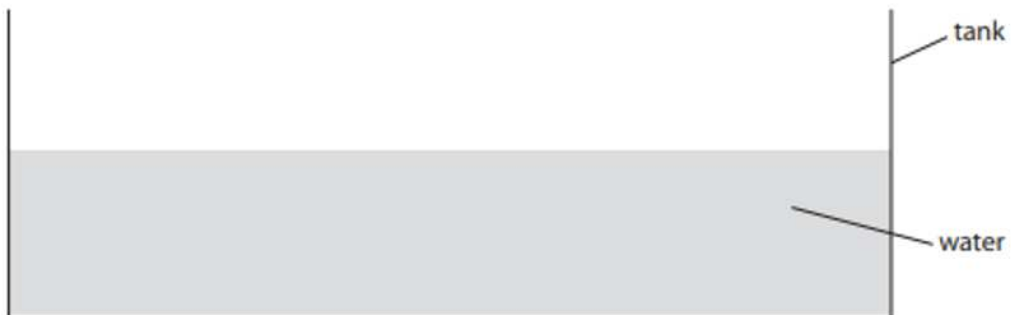


Figure 1

i. The bottom of the tank has an area of 0.80m^2

The force on the bottom of the tank, due to the water, is 2400N

Calculate the pressure, due to the water, on the bottom of the tank.

Pressure = _____

[3 marks]

ii. More water is added to the tank.

Explain how the pressure on the bottom of the tank changes when more water is added to the tank.

.....

.....

.....

[2 marks]

- b. Figure 2 is a graph showing how the atmospheric pressure change with the height above sea level on the Earth's surface.

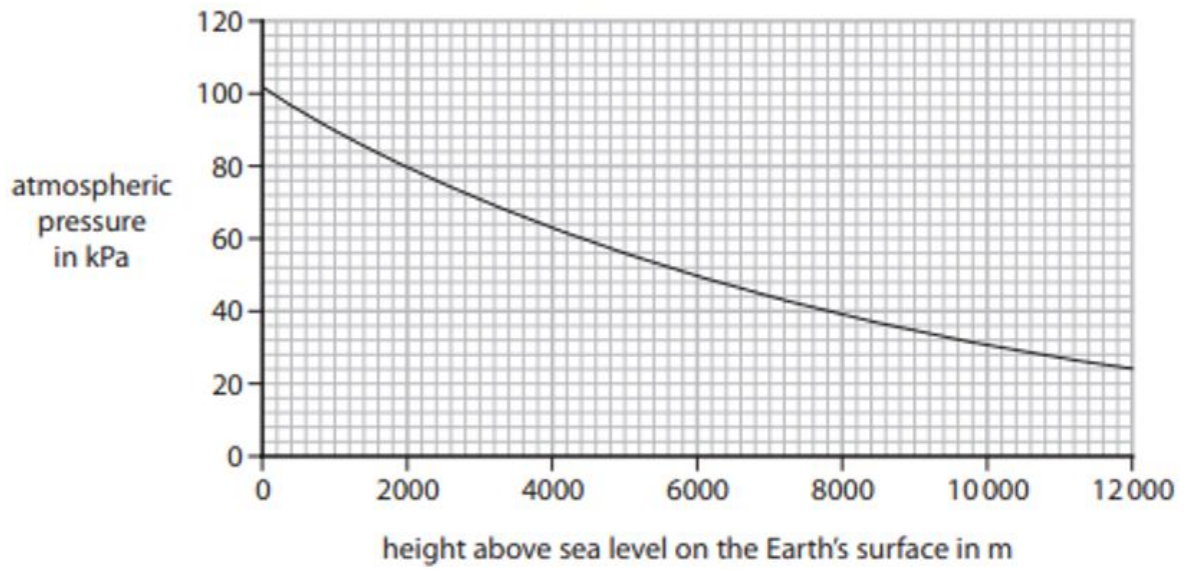


Figure 2

An aeroplane descends from 600m to 2000m.

Use the graph to find the change in atmospheric pressure as the aeroplane descends.

Change in pressure = _____ Pa

[2 marks]

c. Figure 3 show two drawings of the same person on a bed.

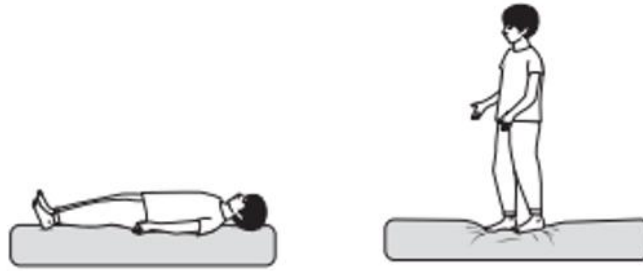


Figure 3

Explain why the person exerts a different pressure on the bed when standing up than when lying down.

.....

.....

.....

[2 Marks]