OUNDLE
School

EXAMINATION PAPER
13+ Academic Scholarship 2023

Science (Paper 1)

Time allowed: 1 hour

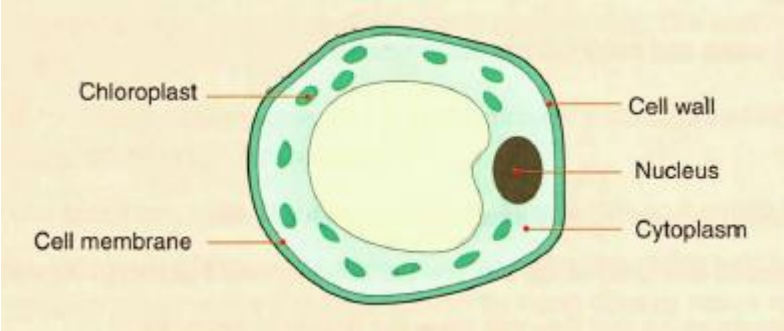
Name: _____

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.

……...……

……...

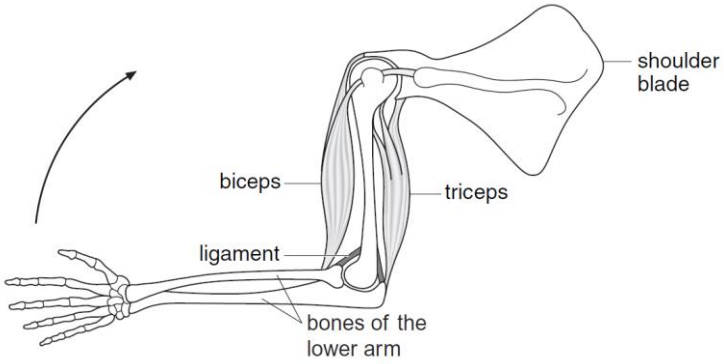
[2 marks]

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.

	The biceps and the triceps contract at the same time.
	The biceps contracts and the triceps relaxes.
	The biceps relaxes and the triceps contracts.
	The biceps and the triceps relax at the same time

[1 mark]

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

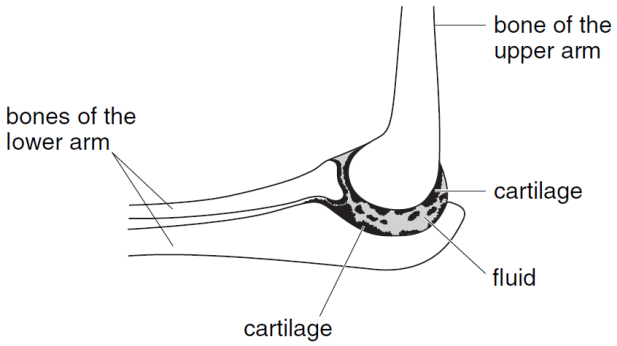
Why must ligaments be able to stretch?

……
…

……
…

[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.

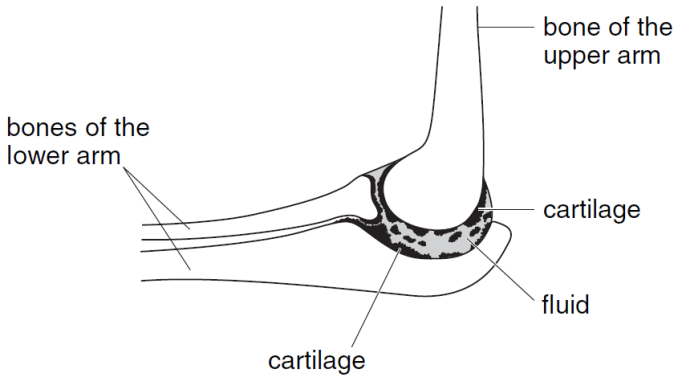
Why are cartilage and fluid needed in a joint?

……

……

[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

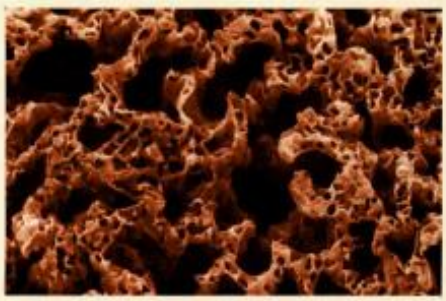
a. What percentage of smokers die from smoking-related diseases?

……

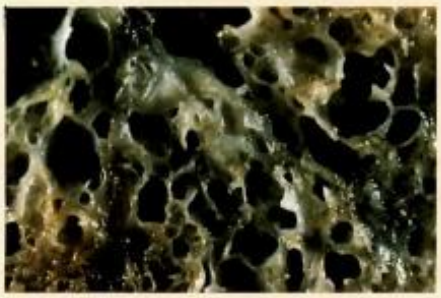
……

[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.



Air sacs (alveoli) in human lung tissue.



A section of lung affected by 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											
1							1 H Hydrogen 1											4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

1. A student investigated the rate of reaction between marble chips and hydrochloric acid. **Figure 1** shows the apparatus the student used.

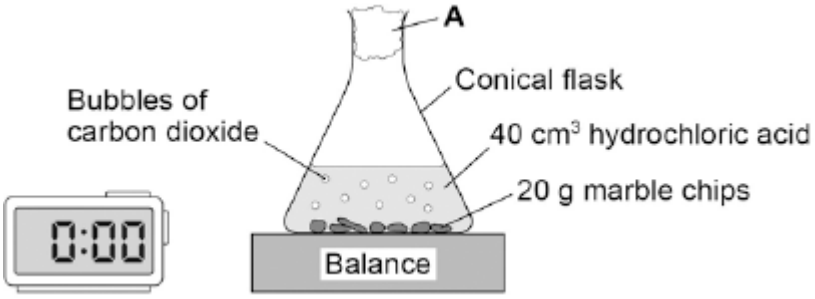


Figure 1

a. What is **A**?

Tick **one** box.

cotton wool ☐

limestone ☐

poly(ethene) ☐

rubber bung ☐

[1 mark]

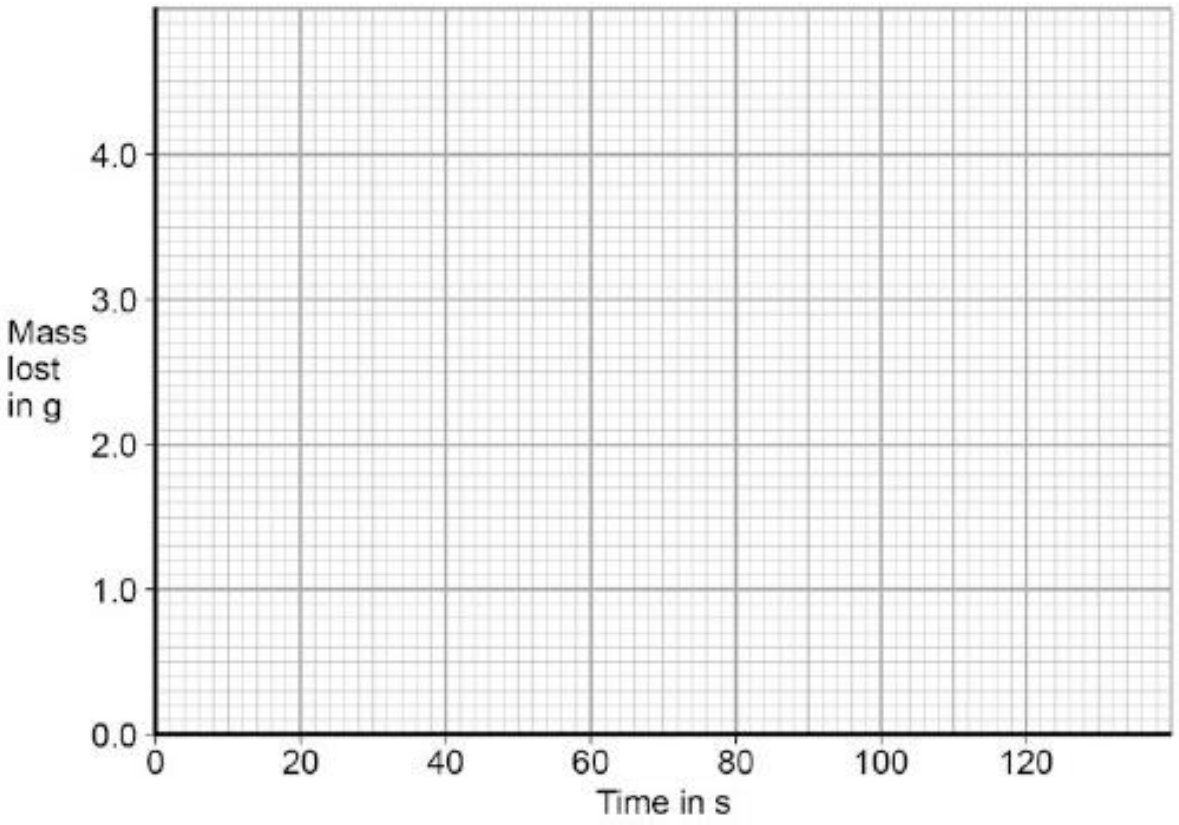
b. **Table 1** shows the student's results for one investigation.

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:

$$2HCl(aq) + CaCO_3(s) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

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:

	$Mg\,(s) + H_2SO_4\,(aq)$ à $MgSO_4\,(aq) + H_2\,(g)$				
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

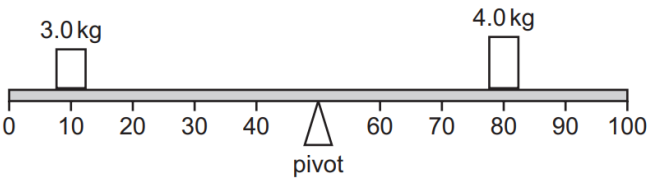
2.

Which substance in the table has the lowest density?

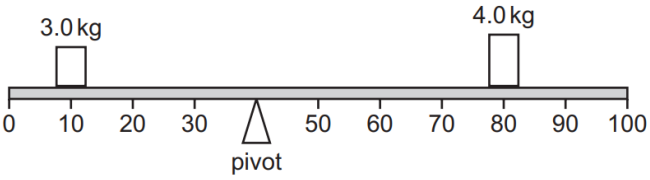
	substance	mass / g	volume / cm^3
A	nylon	1.2	1.0
B	cotton	1.5	1.0
C	olive oil	1.8	2.0
D	water	2.0	2.0

3.

A 100 cm beam balances as shown.



The pivot is moved 10 cm to the left.

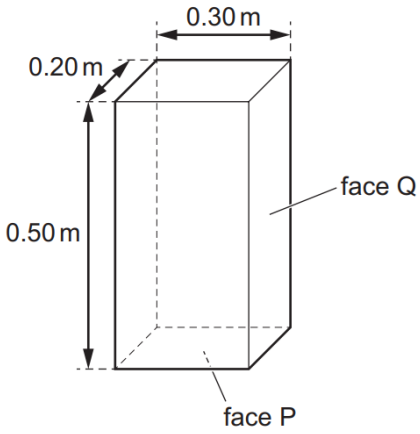


What will be the effect of this change on the anticlockwise and clockwise moments about the pivot?

	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.

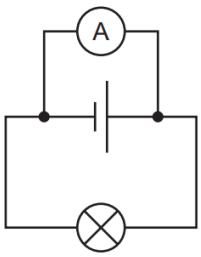
What is the change in pressure on the surface if the box falls over onto face Q?

A $0.0040\,m^2/N$ **B** $0.0067\,m^2/N$ **C** $100\,N/m^2$ **D** $250\,N/m^2$

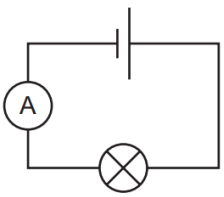
5.

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

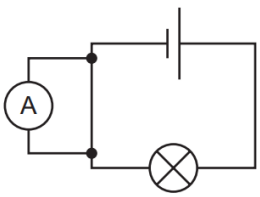
A



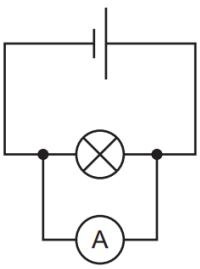
B



C

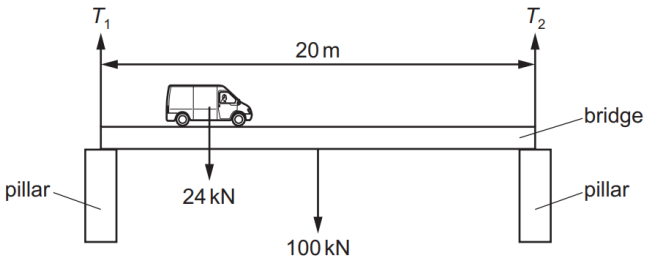


D



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?

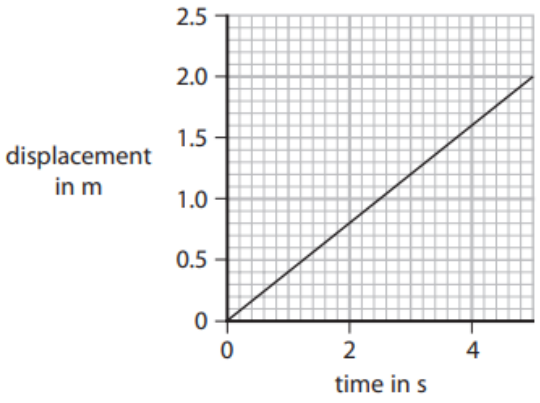
	T_1 / kN	T_2 / kN
A	56	68
B	62	62
C	68	56
D	74	50

7.

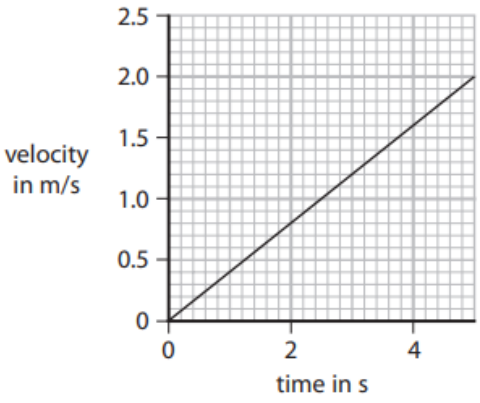
(a) Which of these graphs represents an object moving with a constant velocity of 2 m/s?

(1)

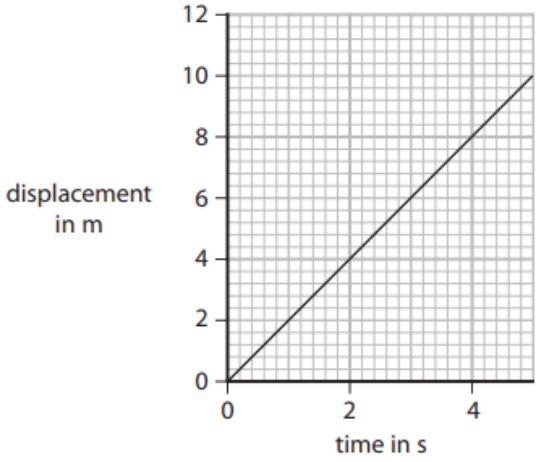
☒ A



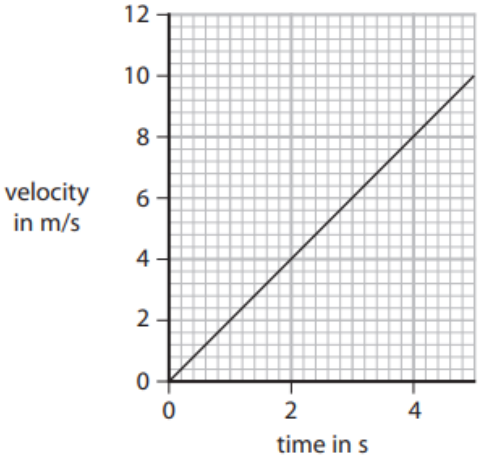
☒ B



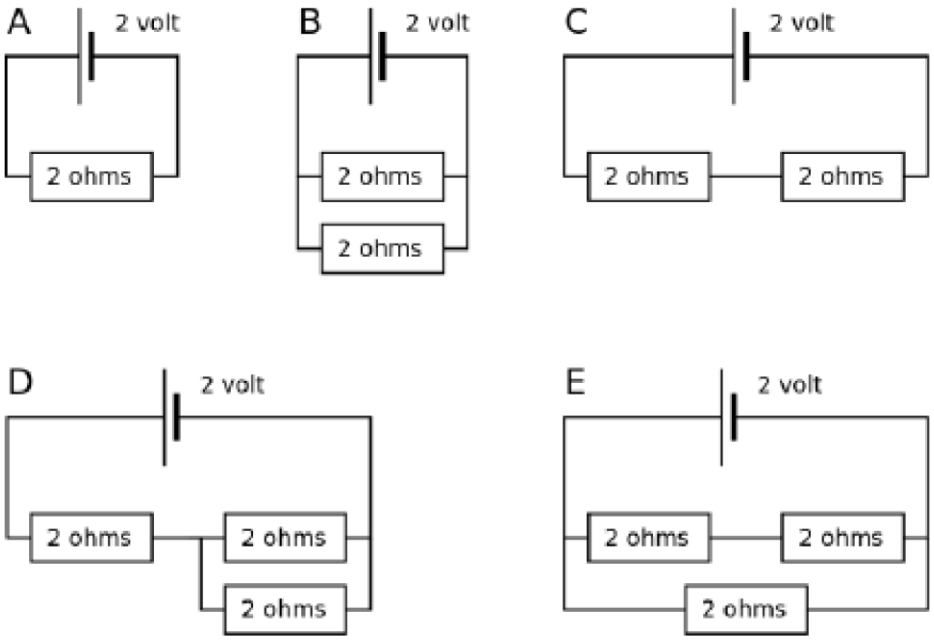
☒ C



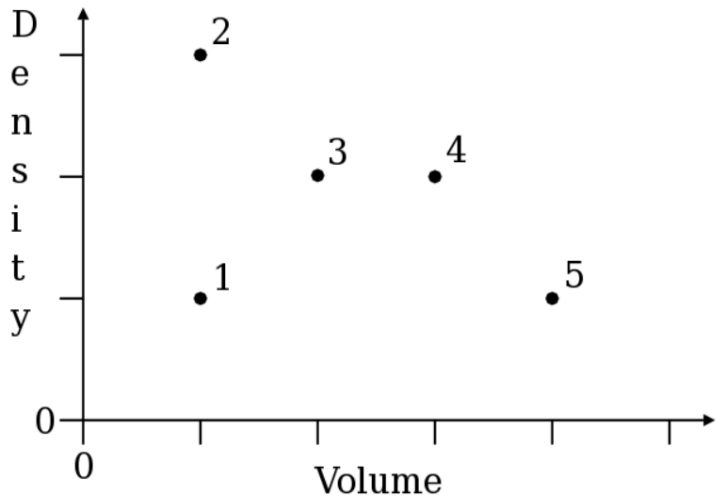
☒ D



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.

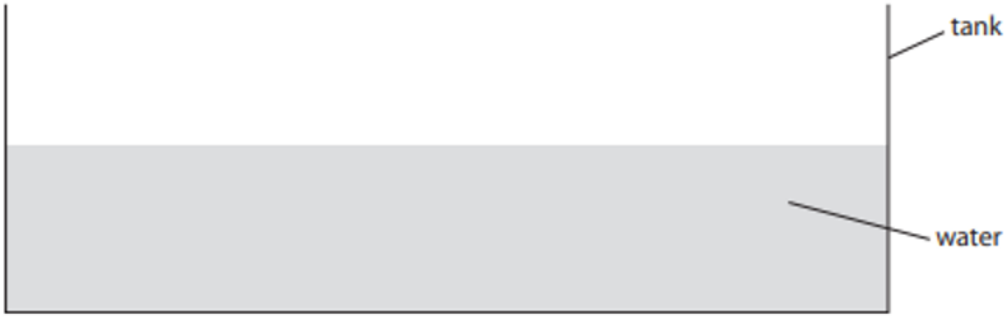


Figure 1

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.

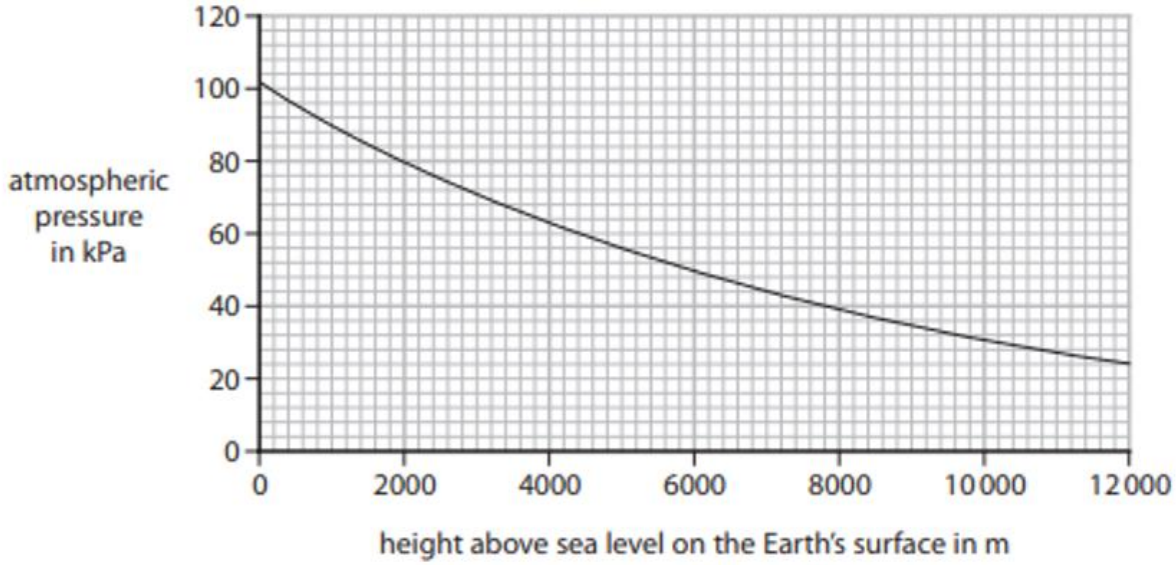


Figure 2

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.

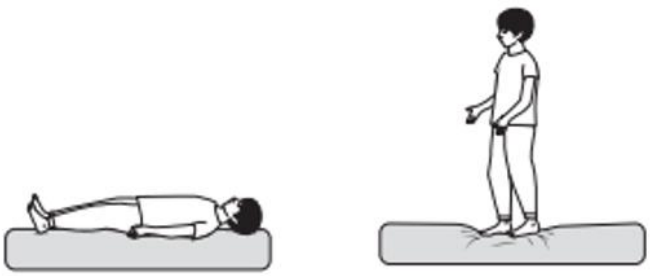


Figure 3

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

……

……

……

[2 Marks]