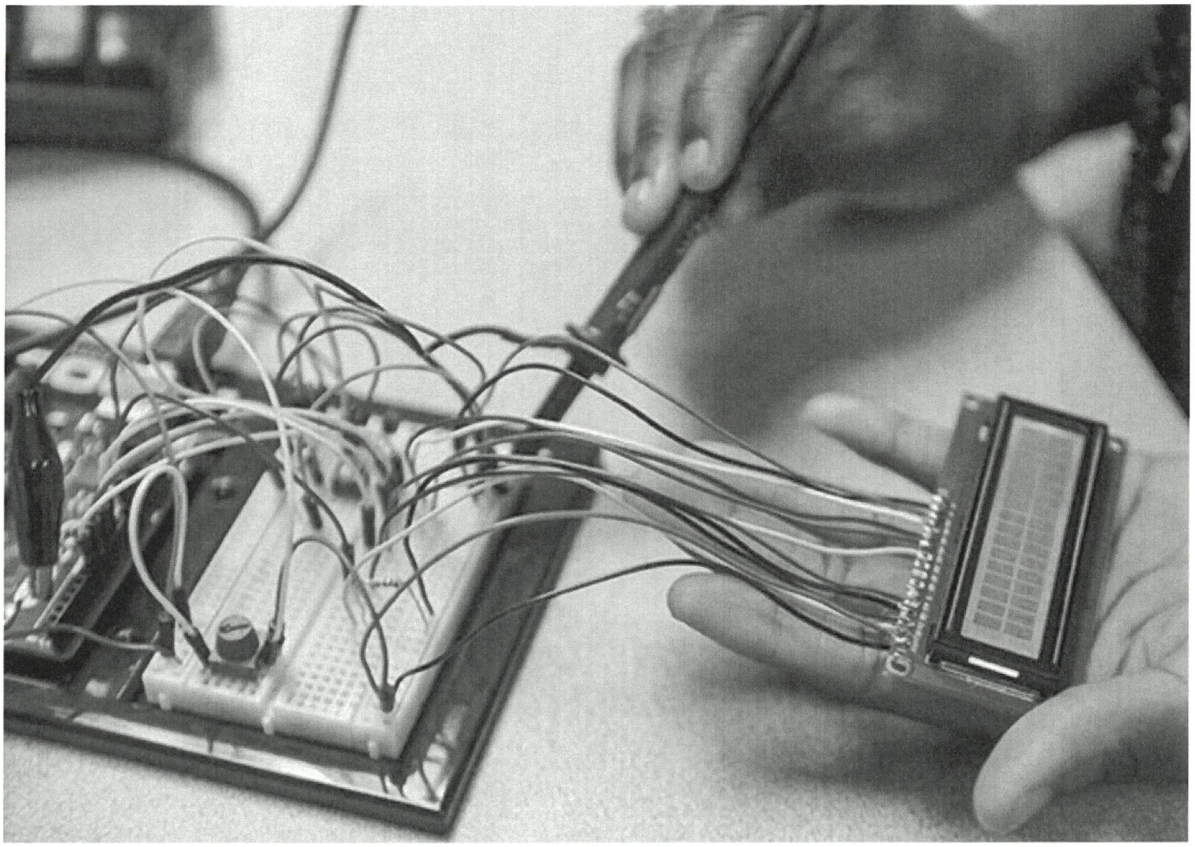
ENGINEERING SUMMER TRANSITION WORK

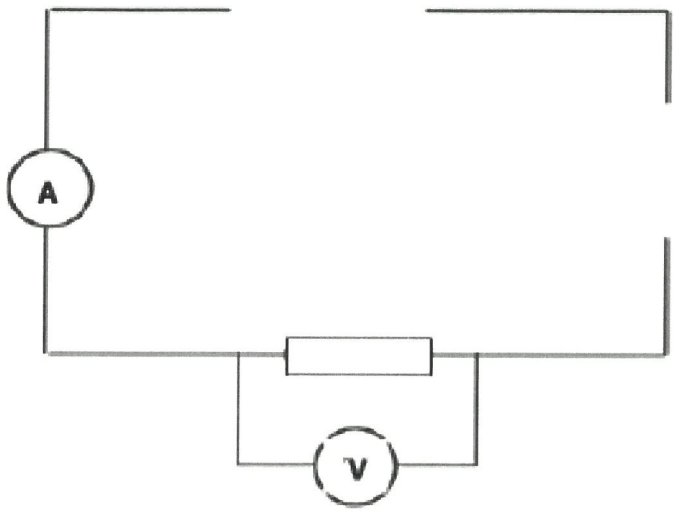
2025



1

a. Melanie is learning about electric charge in circuits.

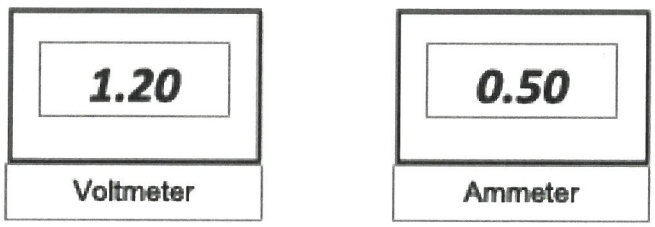
This is an incomplete circuit showing a resistor, a voltmeter and an ammeter.



i. Complete the diagram, using the correct symbols, by adding a switch and a single cell or battery.

[1]

Melanie switches the circuit on and watches the voltmeter and ammeter readings carefully for **30 seconds.** She notices that both readings remain steady as shown below.



ii. Calculate the quantity of electrical charge (in C) which flows through the resistor in 0.5 minutes.

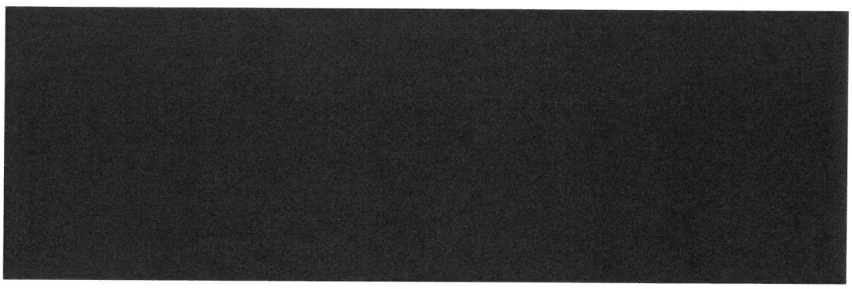
_____C **[3]**

iii. Calculate the resistance of the resistor in the circuit.

_____ Ω [3]

2 This question is about energy transfers in electrical appliances.

The plates on the back of three electrical appliances are shown below.



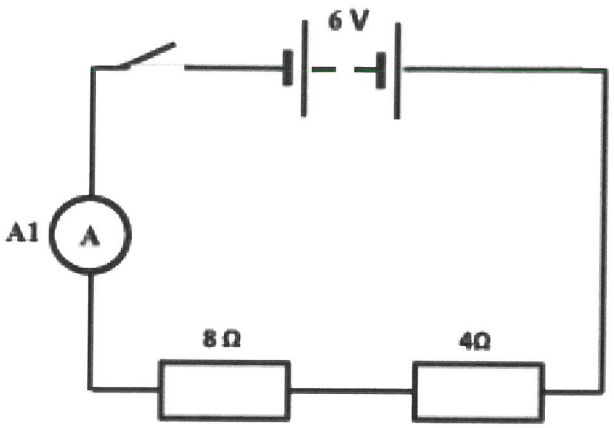
i. Calculate the number of kWh of energy transferred by appliance **A** if it is on for 195 minutes. In your answer use the equation: energy transferred = power × time

_____ kWh [3]

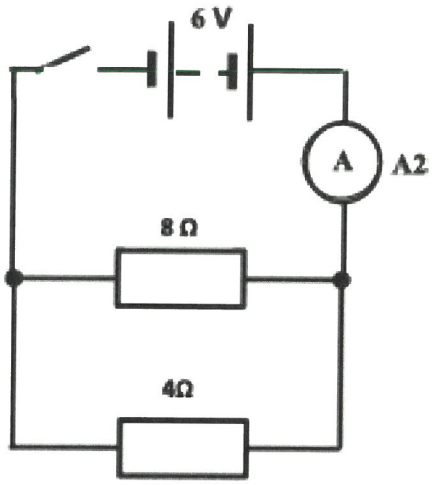
ii. Calculate which appliance (**A**, **B** or **C**) takes the biggest electric current from the mains power supply.

_____ [4]

3 Lydia is comparing series and parallel circuits in a class practical.



Circuit A



Circuit B

Lydia switches on both circuits.

Put a tick (✓) in the box next to the correct answer.

The reading on A_1 is less than the reading on A_2. ☐

The total resistance in circuit B is 6 Ω. ☐

The p.d. across the 8 Ω is the same in both circuits. ☐

The p.d. across A2 is very large ☐

[1]

4 Vikram is building a circuit.

He has a motor that has a resistance of 2400 Ω.

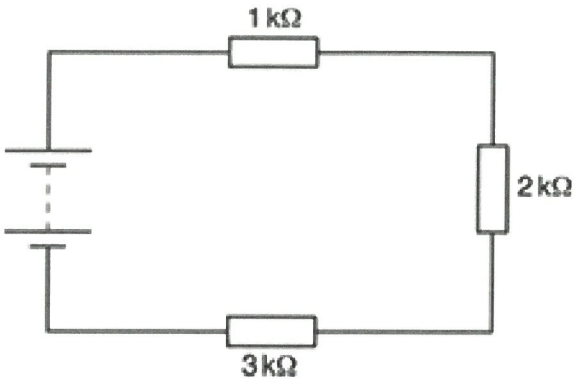
The motor works if the current through it is 0.005 A.

Vikram has some 1.5 V batteries.

How many batteries will be needed to make the motor work correctly?

number of batteries = _____ [3]

5 Susan builds a circuit with three resistors in series.



i. Here are statements about the current in the circuit.
Put a tick (?) in the box next to the correct statement

There is no current in the circuit. ☐

The largest current is in the 3 k? resistor. ☐

The smallest current is in the 3 k? resistor. ☐

The current is the same in all three resistors. ☐

[1]

ii. Which resistor has the largest voltage across it?
Justify your answer.

---

[2]

6 Pat and Chris set up an experiment to find the relationship between the current and voltage for a filament lamp.

When they increase the voltage, the lamp glows brighter.

They record the voltage across the lamp for different values of the current.

Here are their results:

Voltage (V)	0	1.0	2.3	4.2	8.0
Current (A)	0	0.20	0.40	0.60	0.80

Pat says: 'There is no correlation between the voltage and the current.'

Chris says: 'The resistance of the lamp filament does not change because it is the same piece of wire all the time.'

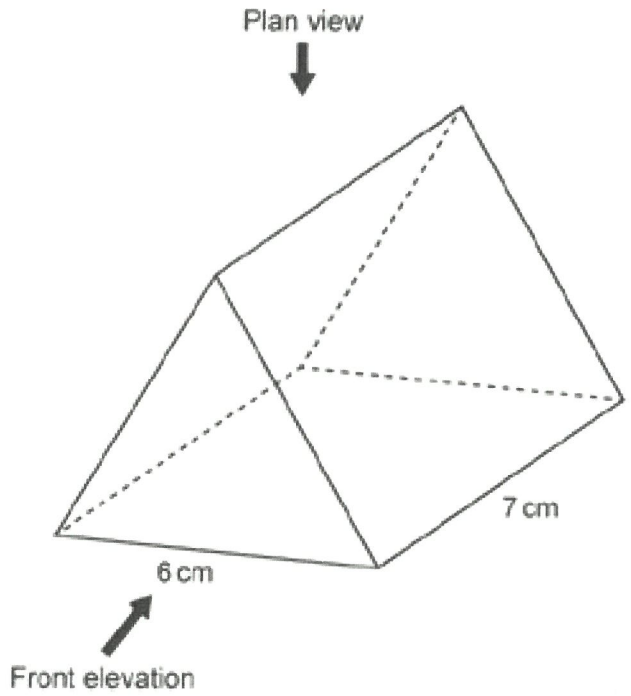
Comment on their statements.
Use the data to justify your answer.

The quality of written communication will be assessed in your answer.

[6]

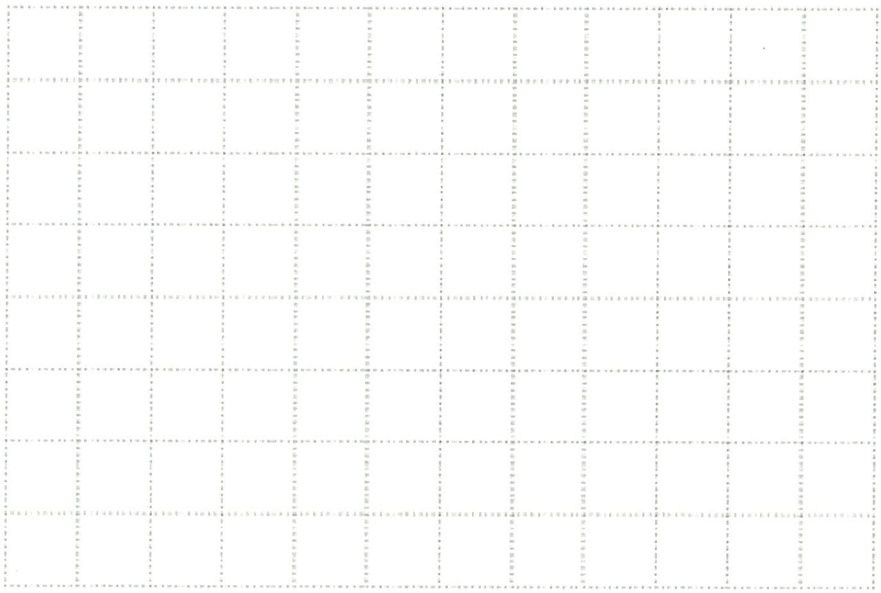
END OF QUESTION PAPER

1 The diagram shows an equilateral triangular prism.
Each side of the equilateral triangle is 6cm and the length of the prism is 7cm.



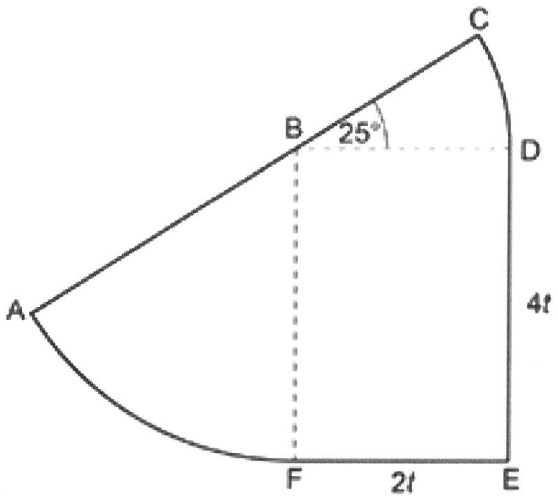
Not to scale

Draw an accurate plan view of the prism on the one-centimetre square grid below.



[3]

2(a) This shape is formed from a rectangle and two sectors of circles.



Not to scale

Points A, B and C lie on a straight line.
Angle CBD = 25°.
DE = $4t$ and EF = $2t$.

Explain why AB = $4t$.
Give a reason for each step of your explanation.

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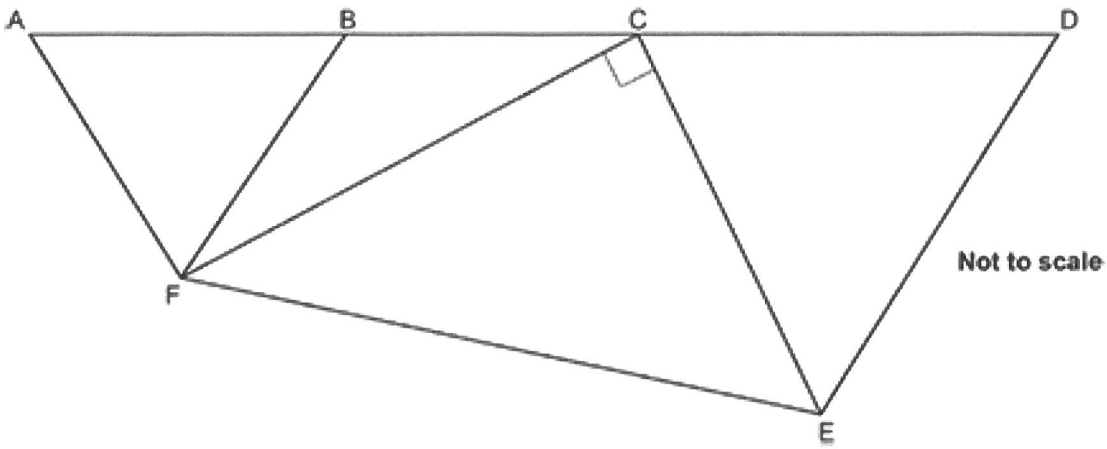
[2]

(b) Show that the perimeter of the shape is $\frac{31}{18}\pi t + 12t$.

[5]

3 The diagram shows four triangles that are joined together.



- Points A, B, C and D lie on a straight line.
- Triangles ABF and CDE are equilateral triangles.
- Triangle CEF is a right-angled triangle.
- Angle ECF is 90°

Show that triangle BCF is an isosceles triangle with BF = BC.
Give a reason for each stage of your working.
Use the template below to help present your work. You may not need all of the lines.

Angle _____ = _____ ° because _____

_____

Angle _____ = _____ ° because _____

_____

Angle _____ = _____ ° because _____

_____

Angle _____ = _____ ° because _____

_____

Angle _____ = _____ ° because _____

_____

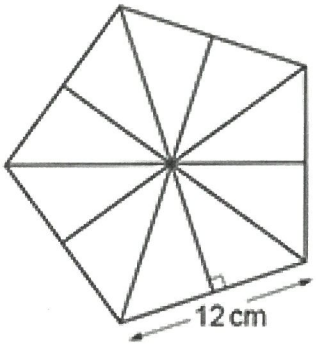
Angle _____ = _____ ° because _____

_____

Angle _____ = _____ ° because _____

_____ [5]

4 The diagram shows a regular pentagon made using ten congruent right-angled triangles.
The length of one side of the pentagon is 12 cm.



Not to scale

Show that the area of the pentagon is 247.75cm^2, correct to 2 decimal places.

[6]

END OF QUESTION PAPER

Digital Electronics

Read: https://www.build-electronic-circuits.com/full-adder/

Watch: https://www.youtube.com/watch?v=wvJc9CZcvBc

Your task:

Build a full adder circuit using the Falstad Circuit Simulator (https://www.falstad.com/circuit/).

On the Falstad simulator there is a full adder circuit already produced (under Circuits>Combinational Logic) but try to build the circuit yourself using the Logic gates under Draw>Logic gate, input and output.

Take screenshots of the circuit you've made and show the results for the different possible input combinations. Spend some time exploring the range of components available and the circuits that can be built.

You can even try building more complex simulations by downloading the free software LTSpice or KiCad.

Write an explanation of how the full adder works to complete binary sums.

Research

How can combinations of logic gates be used to create computer memory? Produce a short account of how this works.