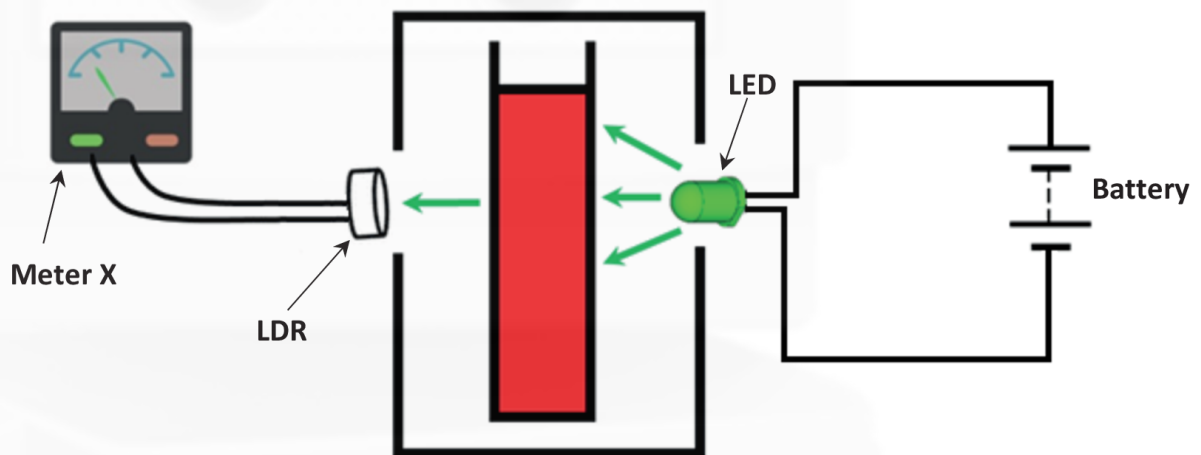


When green light is shone into a red solution, such as blood, some of the light is absorbed, some is reflected and some passes straight through.

A student set up the apparatus shown below to investigate the relationship between the concentration of a red solution and how much green light passes through it.

On one side of the test tube of red solution, green light was emitted from a light emitting diode (LED).

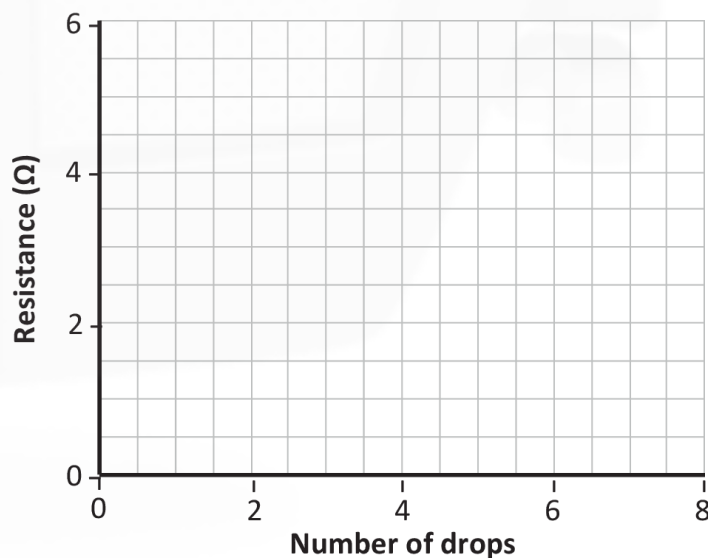
On the other side of the test tube, a light dependent resistor (LDR) was used to detect how much green light passed through the solution.



The student made different concentrations of a solution of red food dye by varying the number of drops of dye added to 20 cm^3 of water. The resistance of the LDR was then determined using meter X. The following results were obtained.

Number of drops of food colouring	0	1	2	3	4	5	6	7	8
Resistance (Ω)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

(a) In the space below, draw a graph of the results obtained.



(b) State one conclusion which is supported by the results.

(c) Name meter **X**, which was used to determine the resistance of the LDR.

--

2

Electrical energy is one of the most important types of energy that we use in our daily lives. An electrical appliance has a power rating which tells you how much electricity it uses.

The table below shows the power rating of some common household appliances and the forms of energy that are produced in the appliances.

Appliance	Power rating (W)	Forms of energy produced	Current used (A)
Coffee maker	1380	Heat, Sound	6
Television	115	Heat, Light, Sound	0.5
Kitchen blender	345	Heat, Kinetic, Sound	1.5
Dishwasher	2300	Heat, Kinetic, Sound	10

(a) Which appliance listed in the table uses the most electrical energy?

--

- (b) Select one of the appliances from the table above and name a useful form of energy produced when the appliance is being used.

Name of appliance:

Useful form of energy:

For the appliance you have selected, name an unwanted form of energy produced.

--

For the appliance you have selected, calculate the voltage applied across the appliance. Include the unit for your answer.

Calculation

- (c) What pattern, if any, exists between the power rating of the appliance and the current used?

3

- (f) JunoCam, a camera on the Juno probe, is powered by Juno's solar panels.

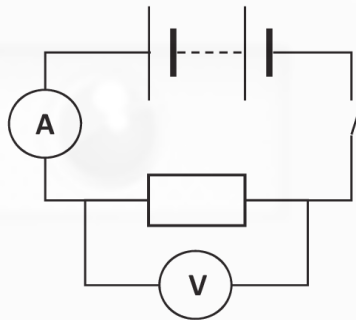
Calculate the electrical power (P) generated by JunoCam when it uses a current of 0.5 A flowing across a potential difference (voltage) of 12 V.

Calculation



A student investigated the relationship between the potential difference (voltage) across a resistor and the current flowing through it.

The circuit diagram below shows the arrangement of the apparatus used by the student.



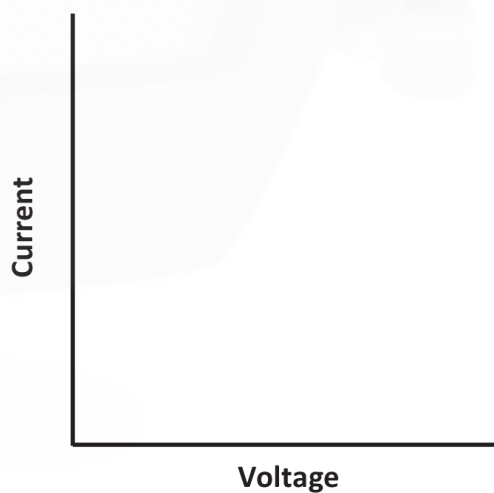
Examine the circuit diagram and answer the questions below.

- (a) The instrument labelled **V** measures voltage. Name instrument **V**.

- (b) The instrument labelled **A** measures current. Name instrument **A**.

- (c) In the circuit diagram above, draw a circle around the symbol for the switch.

- (d) The student found that current is proportional to voltage for this resistor. Using the axes provided, draw a sketch of a graph to show this relationship.

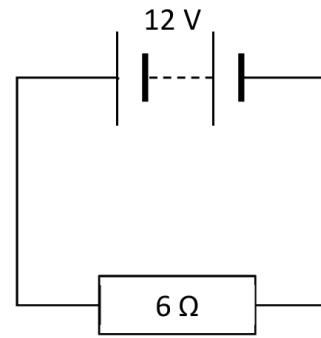


(c) The relationship between voltage, current and resistance in an electrical circuit is named after the physicist Georg Ohm.



Use Ohm's law to calculate the current in the circuit shown.

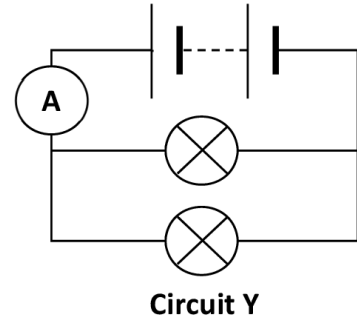
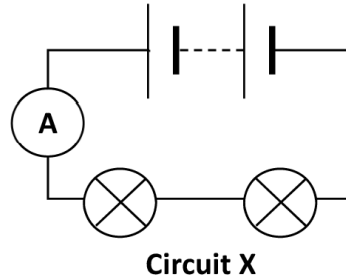
Calculation



(h) The diagrams show bulbs connected in series and in parallel across a battery.

(i) In which circuit, **X** or **Y**, are the bulbs connected in series? _____

(ii) Name device **A**.



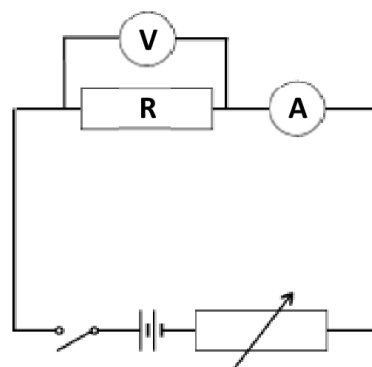
(iii) Tick (✓) the correct statements for each circuit, **X** or **Y**.

Statement	Circuit X	Circuit Y
The bulbs are brighter.	<input type="checkbox"/>	<input type="checkbox"/>
If one bulb is unscrewed, no bulb will light.	<input type="checkbox"/>	<input type="checkbox"/>

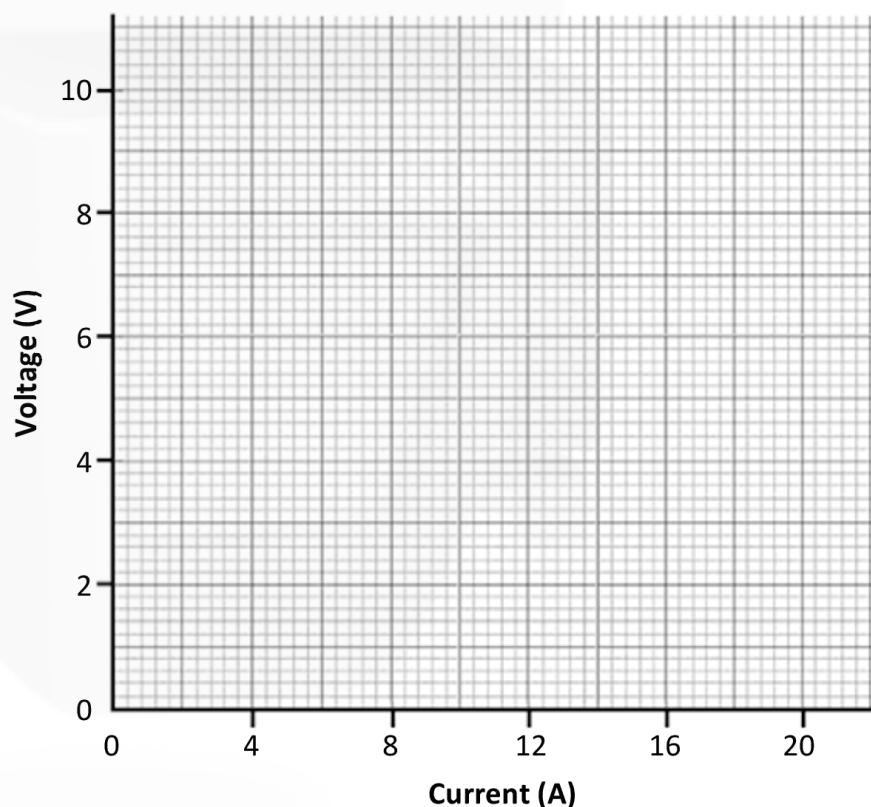
- (a) A student used the circuit shown to investigate the relationship between the potential difference (voltage) across a resistor and the current flowing through it.

The results are given in the table below. (21)

Voltage (V)	2	4	6	8	10
Current (A)	3.6	7.2	10.8	14.4	18.0



- (i) Draw a graph of voltage against current for these results.



- (ii) What is the relationship between voltage and current shown by your graph?

- (iii) Calculate the resistance of the resistor.

Calculation

- (iv) What happens to the resistor when current flows through it?

(1)

(2)

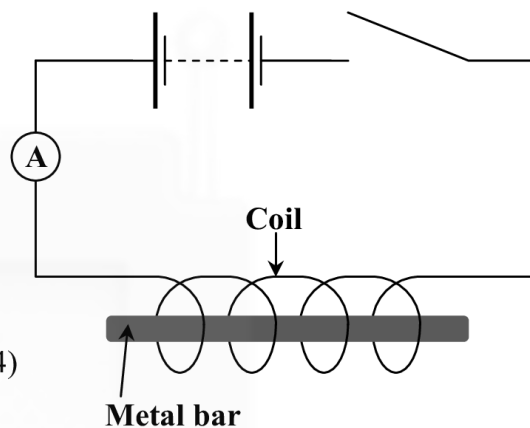
(b) A student was asked to test electrical conduction in *paper*, *copper*, *silver* and *plastic* and conclude which of these materials were electrical conductors and which were insulators. (9)

(i) Draw a labelled diagram of the set up (circuit) the student could use.



(ii) Based on the circuit you drew above, how could you tell which materials were electrical conductors? _____

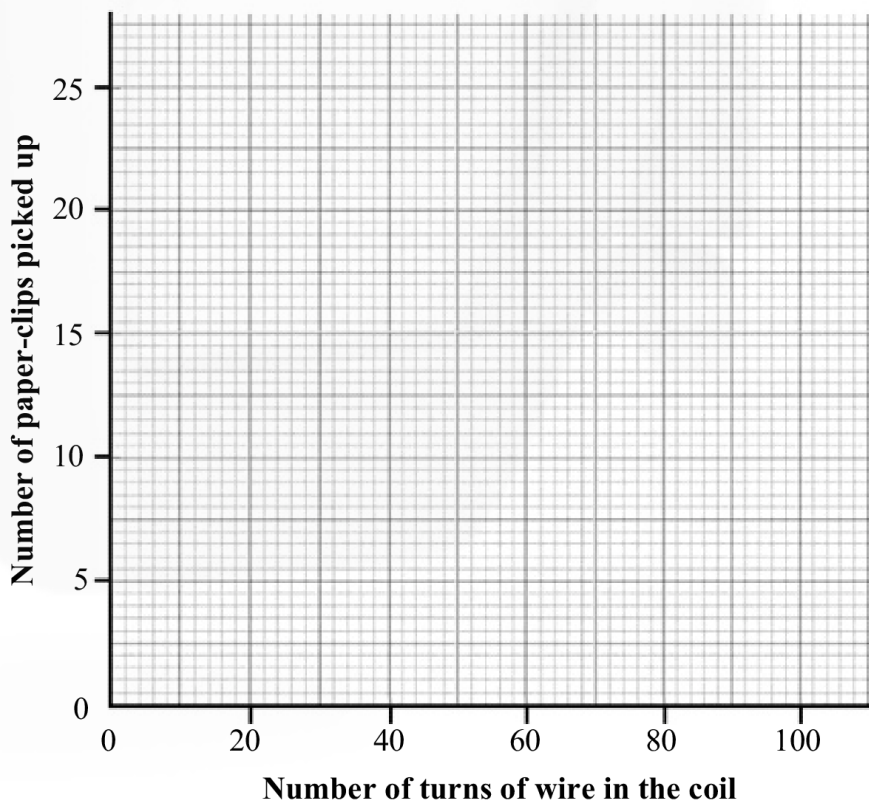
- (a) A student set up the circuit shown to investigate the magnetic effect of a constant electric current. She varied the number of turns of wire in the coil and counted how many paper-clips were picked up by the metal bar each time. (24)
Her results are given in the table below.



Number of turns of wire in the coil	20	40	60	80	100
Number of paper-clips picked up	5	11	16	20	26

- (i) Name a suitable material from which the bar and the paper-clips should be made.

- (ii) Name the instrument labelled **A** in the circuit diagram. _____
What does this instrument measure? _____
- (iii) Draw a graph in the grid below of the number of paper-clips picked up *versus* the number of turns of wire in the coil.



use only

(1) (2)

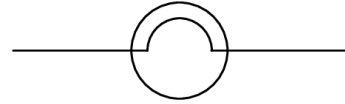
(iv) Use your graph to estimate how many paper-clips would be picked up if there were 30 turns of wire in the coil. _____

(v) State one way in which the student might have made sure that this investigation was a fair one. _____

(c) The symbol shown on the right is that of a light bulb.

In each of the spaces provided, draw two bulbs so that they are arranged (i) in series and (ii) in parallel.

(6)



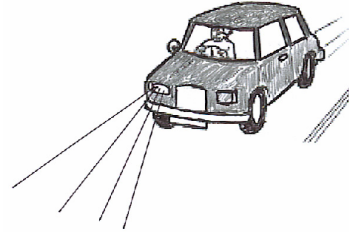
(i) Two bulbs in series

(ii) Two bulbs in parallel

(1) (2)

(b) Components, e.g. bulbs, in electrical circuits can be connected in *series* or in *parallel*.

- (i) It is noticed that, when one headlight fails (blows) in a car, the second remains lighting.



State *the way the headlights are connected* and give a *reason* why this mode of connection is used. (6)

State the way _____

Reason _____

- (ii) All of the bulbs go out in an old set of Christmas tree lights, when one of bulbs fails (blows). In *what way are the bulbs connected* in this set of lights?



Explain why, when *one bulb blows*, *they all go out*. (6)

What way? _____

Explain _____

- (iii) Calculate the *resistance of the filament* of a car headlamp when 12 V produces a current of 5 A in it.

In what unit is resistance measured? (6)

Resistance _____

Unit of resistance _____

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examiner
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(1) (2)

