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90937



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SUPERVISOR'S USE ONLY

Level 1 Physics, 2017

90937 Demonstrate understanding of aspects of electricity and magnetism

9.30 a.m. Tuesday 28 November 2017
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of electricity and magnetism.	Demonstrate in-depth understanding of aspects of electricity and magnetism.	Demonstrate comprehensive understanding of aspects of electricity and magnetism.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

Make sure that you have Resource Sheet L1–PHYSR.

In your answers use clear numerical working, words and/or diagrams as required.

Numerical answers should be given with an appropriate SI unit.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

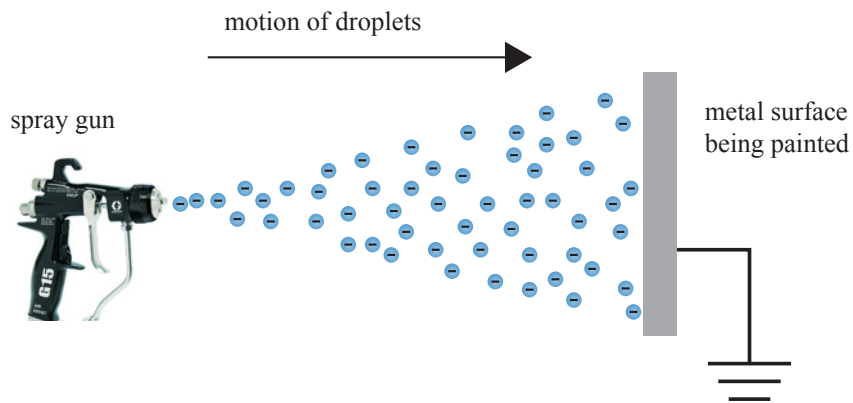
ASSESSOR'S USE ONLY

QUESTION ONE: SPRAY PAINTING

A paint gun sprays tiny droplets of paint at a metal surface. Paint droplets are initially neutral, but become negatively charged as they leave the metal spray gun nozzle.



<http://www.zamar.it/sabbiatura-ad-umido>



http://www.grapekaction.com/air_assisted_airless_airmix_type_manual_spray_guns

- (a) Describe the key property of metal that makes it suitable for painting with this technique.
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- (b) One reason for charging the droplets is to ensure the paint is spread evenly across a wider area of the surface being painted.
- (i) When two negatively charged droplets are near each other, they exert electric forces on each other.

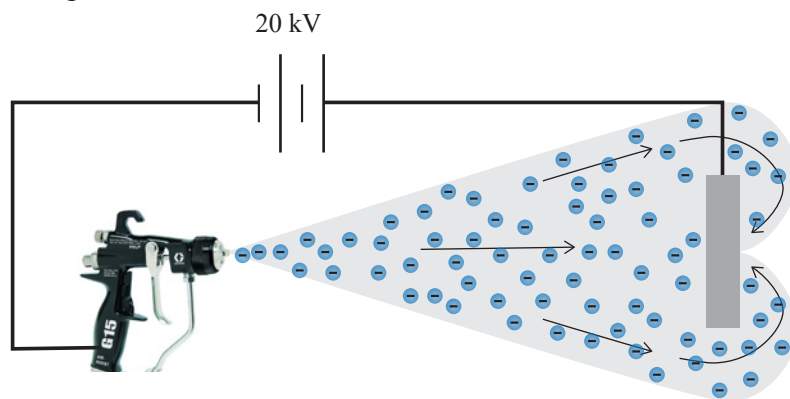
On the diagram below, draw arrows to show the electric **force** acting on **each** droplet.



If you need to redraw this, use the diagram on page 10.

- (ii) Explain how negatively charging the droplets helps the paint spread evenly across a wider area.

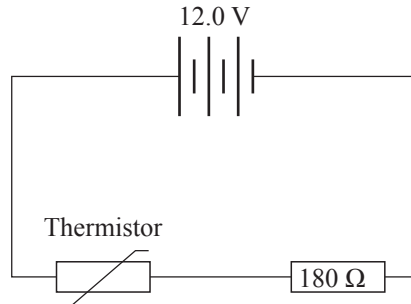
- (c) When spray painting metal objects, a power supply can be connected, which allows the back of the object to be painted.



Explain how connecting a power supply to the metal sheet in this way allows the back of the metal sheet to be painted.

QUESTION TWO: THERMOSTAT

A thermostat is a circuit that is used to switch equipment on and off, depending on the temperature. A simple thermostat circuit consists of a power supply, resistor, and thermistor connected in series as shown below. A thermistor is a special type of resistor that changes resistance as temperature changes.



If you need to redraw this, use the diagram on page 10.

- (a) A voltmeter is added to the circuit to measure the voltage applied to the thermistor.

On the diagram above, draw the symbol for a voltmeter correctly connected to make this measurement.

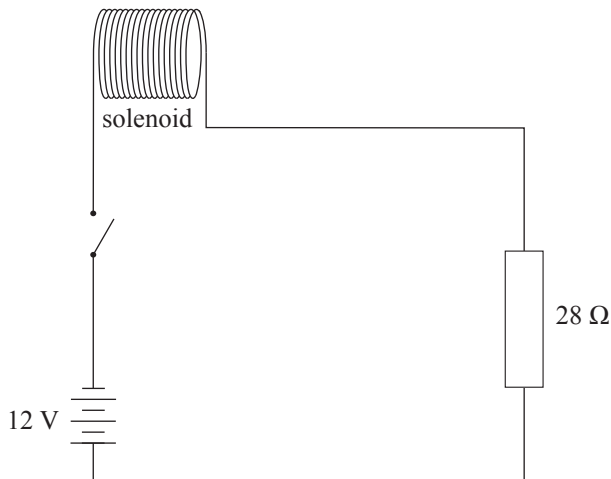
- (b) (i) At a temperature of 25°C the current in the circuit is 0.014 A .

Show that the total resistance of the circuit at 25°C is $860\ \Omega$.

- (ii) Calculate the resistance of the thermistor at 25°C .

QUESTION THREE: MAGNETIC DOOR LOCK

A magnetic door lock consists of a solenoid attached to the door frame and a plate attached to the door. A simplified diagram of the solenoid circuit is shown below.



www.corplock.com.au/magnetic-lock-systems

If you need to redraw this, use the diagram on page 10.

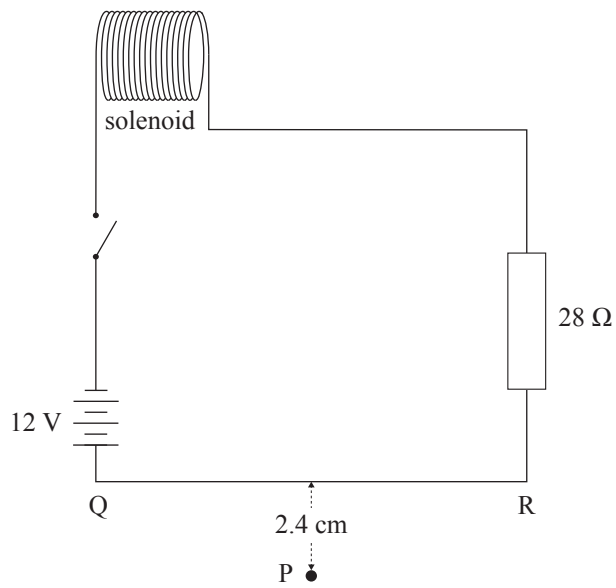
- (a) When the switch is closed, current flows through the solenoid, which produces a magnetic field.

On the diagram above sketch the shape and direction of the magnetic field produced by the solenoid. Label the north and south poles of the solenoid.

- (b) The resistance of the solenoid is negligible in this circuit.

Show that when the switch is closed, the current in the circuit is 0.43 A.

- (c) Point P is far enough away from the solenoid that the magnetic field from the solenoid is insignificant. However there is still a magnetic field, due to the current along the wire between Q and R.



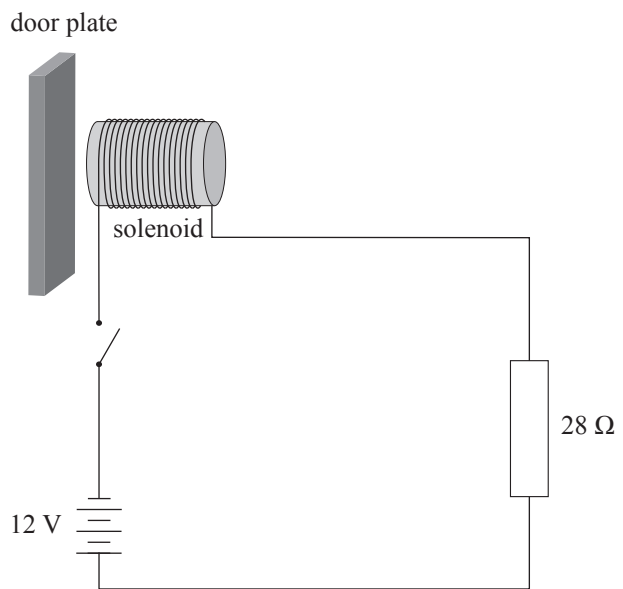
Calculate the size and state the direction of the magnetic field at point P, due to the current in the wire between points Q and R.

- (d) When used in a door lock, the solenoid has a core and the door plate is near the end of the solenoid. The door plate and solenoid core are made of the same material.

Explain how the door can be locked using this system.

In your answer you should:

- state whether opening or closing the switch locks the door
- describe how doing this locks the door
- name a suitable material for both the door plate and solenoid core, and explain why this material is suitable.

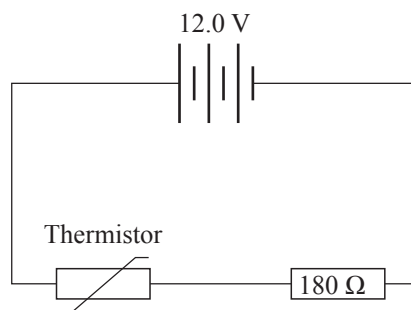


SPARE DIAGRAMS

If you need to redraw your diagram from Question One (b)(i), draw it below. Make sure it is clear which answer you want marked.



If you need to redraw your diagram from Question Two (a), draw it below. Make sure it is clear which answer you want marked.



If you need to redraw your diagram from Question Three (a), draw it below. Make sure it is clear which answer you want marked.

