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Support Pack | Grade 12

CAPS

Physical Sciences

Electricity and magnetism

This support pack for the **Electricity and magnetism** module in the **Physical Sciences Grade 12 CAPS curriculum** provides valuable practice exercises. All questions have the answers provided. Learners can work through these individually at home or these could form the basis of a catch-up class or online lesson. You have permission to print or photocopy this document or distribute it electronically via email or WhatsApp.

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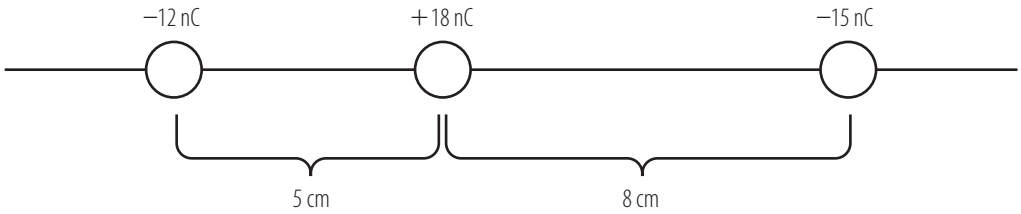
We are all in this together!

Revision exercises for Electricity and magnetism

Question 1

The diagram below shows three point charges placed along a line.



Determine the resultant electric force on the +18 nC charge.

Question 2

Two identical charges are placed with their centres 60 mm apart. The one exerts a force of 9×10^{-5} N on the other. Calculate the size of the two charges.

Question 3

Two charges Q and q exert a force F on each other when they are a distance d apart. What will the force become if:

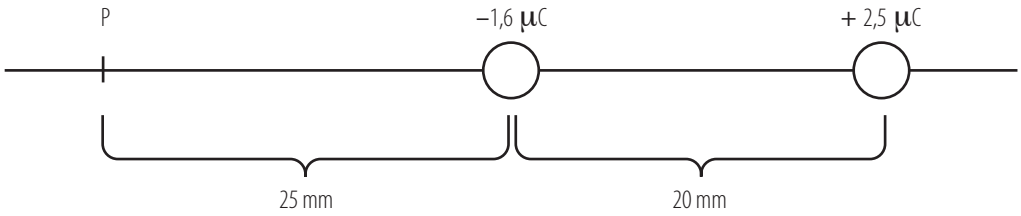
a) Q is made three times bigger and q is made four times bigger.
b) The distance between the original charges is halved.

Question 4

A test charge of 1,2 nC is placed at a point in the electric field of a positive charge where the force it experiences is 6×10^{-4} N. Determine the magnitude of the electric field at that point.

Question 5

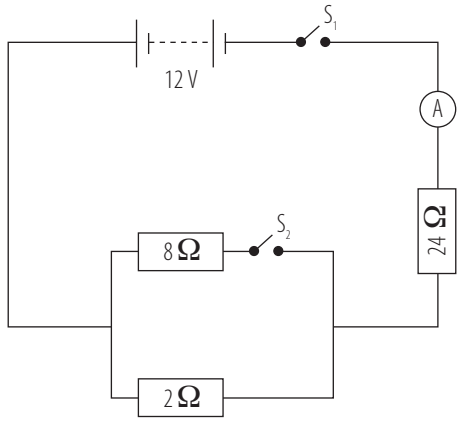
The diagram below shows two stationary charged spheres.



Find the net electric field at point P.

Question 6

In the circuit shown below, the battery has a negligible internal resistance. Switches S_1 and S_2 are both closed.

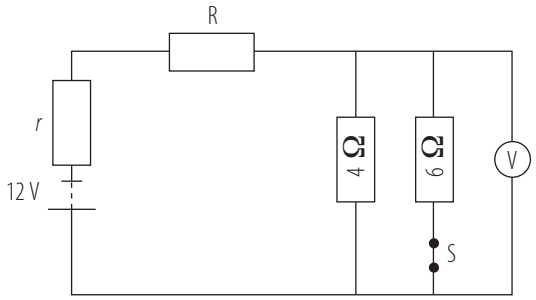


a) Determine the following:
   i) The total resistance in the circuit.
   ii) The reading on the ammeter.
   iii) The current in the 8 Ω resistor.

b) Switch S_2 is now opened. What effect will this have on the ammeter reading? (Answer without doing any further calculations.)

Question 7

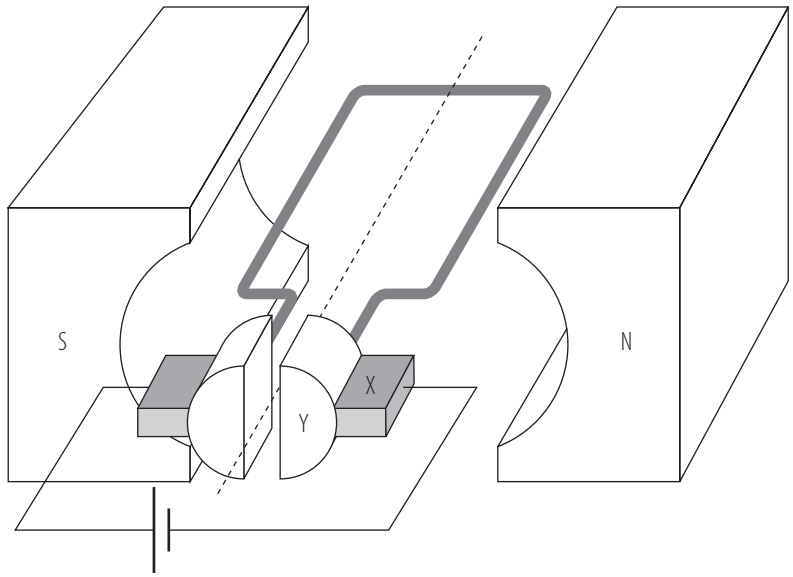
The circuit below shows a battery of emf 12 V with an unknown internal resistance, *r*. The power generated in the unknown resistor R is 12 W, while the voltmeter reads 4,8 V.



a) Determine the equivalent resistance of the parallel resistors.
b) Calculate the current through the resistor R.
c) Find the resistance of the resistor R.
d) Determine the internal resistance of the battery.
e) If the switch (S) is now opened, will the reading on the voltmeter increase or decrease or remain the same?

Question 8

The illustration below shows one loop of a coil of an electric motor.



a) In which direction will the coil rotate?
Clockwise or anti-clockwise?
b) What is the function of the part labelled X?
c) What is the function of the part labelled Y?
d) What changes must be done to the coil to increase the speed of the motor?

Question 9

State Faraday's Law.

Question 10

Why is most of our power generated as AC instead of DC?

Question 11

A direct current motor can be used as a direct current generator.

a) What is the main difference between the DC motor and DC generator?
b) Draw a graph of the induced emf in a DC generator.

Question 12

The peak value of the AC voltage in the mains supply of most of our homes is 311 V.

a) What is the rms voltage of the mains supply?
b) If a 4 kW kettle is connected to the AC mains supply, what will be the rms current in the kettle?
c) Determine the resistance of the kettle.

Memorandum for revision exercises

1 $4{,}0 \times 10^{-4}$ N, to the left

2 6 nC

3 a) $12F$

b) $4F$

4 5×10^{5} N·C^{-1}

5 $1{,}2 \times 10^{7}$ N, to the right

6 a) i) 4 Ω

ii) 3 A

iii) 0,6 A

b) The ammeter reading will decrease.

7 a) 2,4 Ω

b) 2 A

c) 3 Ω

d) 0,6 Ω

e) The voltmeter reading will increase.

8 a) The coil will rotate in a clockwise direction.

b) The brushes (X) provide electrical contact between the battery and the coil.

c) The split ring commutator (Y) changes the direction of the current in the coil after every half-cycle so that the coil continues to rotate in one direction only.

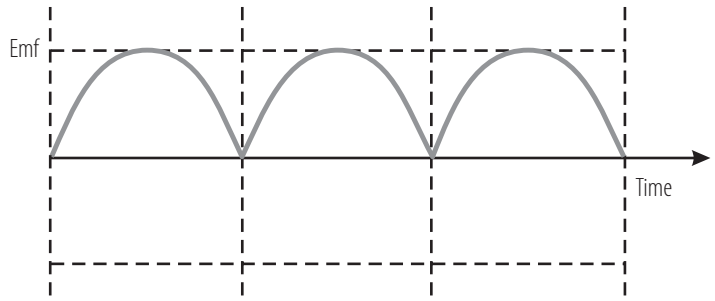
d) Increase the number of turns in the coil to increase the speed of the motor.

9 Faraday's Law: The induced emf in a conductor is equal to the time rate of change of magnetic flux.

10 AC can be stepped up or down by transformers to minimise power losses during transmission, while DC cannot be stepped up or down by transformers.

11 a) The DC motor converts electrical energy into mechanical energy, while the DC generator converts mechanical energy into electrical energy.

b)



12 a) 220 V

b) 18 A

c) 12 Ω