Charge and current – 2021/20 GCE Physics A Component 02

1. Nov/2021/Paper_H556_02/No.4

The diagram below shows two oppositely charged spheres.

The magnitude of the charge on each sphere is the same.
The point **P** is on the line joining the centres of the spheres and is the same distance from the centre of each sphere.

Which statement is correct?

A A negatively charged particle at **P** will move to the right.

B The direction of the electric field at **P** is to the left.

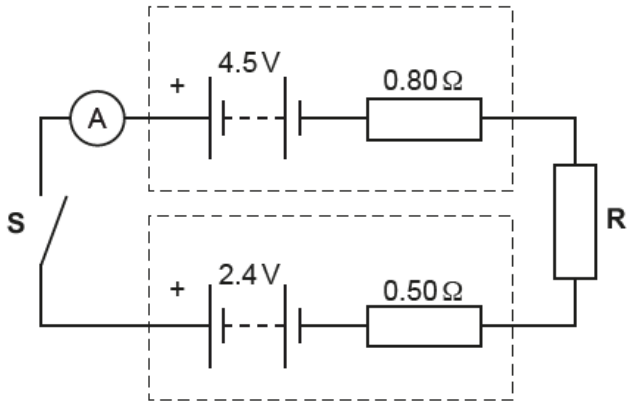
C The electric potential at **P** is zero.

D The magnitude of the electric field strength at **P** is zero.

Your answer ☐ **[1]**

2. Nov/2021/Paper_H556_02/No.18(a)

(a) The circuit diagram of an electrical circuit is shown below.



The positive terminals of the batteries are connected together.
One battery has electromotive force (e.m.f.) 4.5 V and internal resistance 0.80 Ω.
The other battery has e.m.f. 2.4 V and internal resistance 0.50 Ω.
R is a coil of insulated wire of resistance 1.2 Ω at room temperature.

The switch **S** is closed.

(i) On the diagram, draw an arrow to show the direction of the conventional current. **[1]**

(ii) Calculate the current I shown by the ammeter.

I = ... A **[3]**

(iii) The insulated wire has diameter 4.6×10^{-4} m.
The number density of charge carriers in **R** is 4.2×10^{28} m^{-3}.

Calculate the mean drift velocity v of the charge carriers in **R**.

v = ... m s^{-1} **[2]**

(iv) The current measured by the ammeter is smaller than that calculated in **(ii)**. This is because the temperature of **R** increased due to heating by the current.

Without any changes to the circuit itself, state and explain what practically can be done to make the measured current the same as the calculated current..

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..... **[2]**

3. Nov/2020Paper_H556_02/No.2

Which sequence shows the materials arranged in the order of increasing number density of charge carriers?

increasing number density ⟶

A conductor, insulator, semiconductor

B conductor, semiconductor, insulator

C insulator, semiconductor, conductor

D semiconductor, insulator, conductor

Your answer ☐ **[1]**