Electronics

CORE questions

Core 1

The circuit for adjusting the brightness of the lamp in the display panel of a car is shown in Fig.10.1.

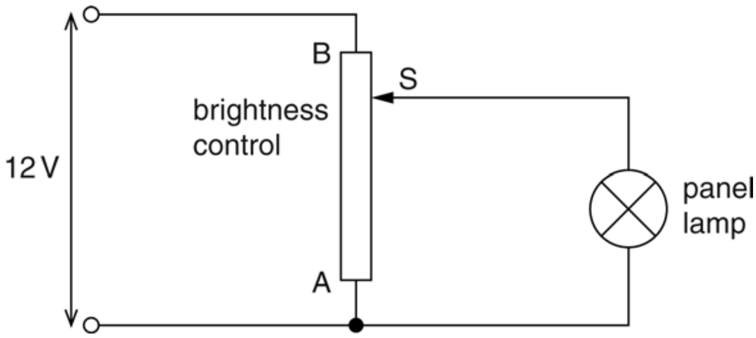


Fig. 10.1

The brightness control is uniformly wound with resistance wire and has a sliding contact S.

(a) State the name of the component used as the brightness control.

....[1]

(b) State the potential difference across the panel lamp when

(i) S is at end A, ... V

(ii) S is at end B. V

[2]

(c) Describe what happens to the brightness of the lamp as S is moved **from A to B**.

....

....[2]

[Total: 5]

ALTERNATIVE TO PRACTICAL questions

Alternative to Practical 1

(a) The circuit symbol for a diode is shown in Fig. 3. The diode conducts when the polarity is as shown.

Fig. 3

Draw a circuit diagram showing the following components, all connected in series:
a d.c. power supply, labelled to show its polarity,
a fixed resistor,
a diode,
a switch.

On your circuit diagram, the switch should be shown open and the diode should be able to conduct when the switch is closed.

[3]

(b) (i) Redraw your circuit diagram, adding an ammeter to measure the current in the diode. Label the polarity of the ammeter terminals.

(ii) Is there any other position in the circuit where you could put the ammeter to measure the current through the diode? Tick one box.

yes	
no	

Give one reason to support your answer.

....

....

....
[3]

Alternative to Practical 1

(c) **(i)** Assuming that the fixed resistor has a resistance of 100 Ω and that the potential difference of the power supply is 3.0 V, calculate the maximum current I_{max} in the circuit

I_{max} = ...

(ii) In order to calculate the value for I_{max} in **(i)** above, what assumption did you make about the resistance of the circuit?

....

....
[2]

EXTENSION questions

Extension 1

(a) Fig. 4 shows a beam of electrons about to enter the region between two charged metal plates.

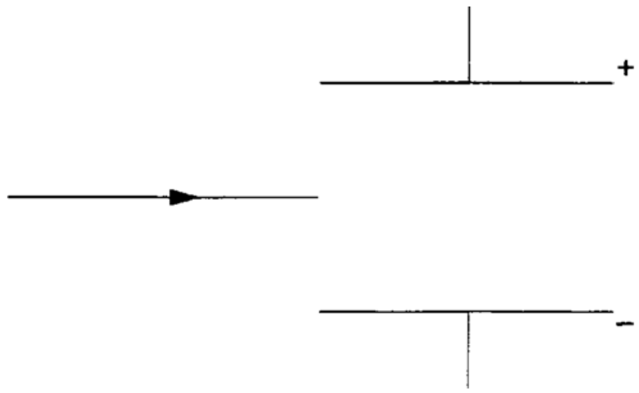


Fig. 4

On Fig. 9.1 continue the path of the electron beam between the plates

(i) for plates with a very small charge (label this path **P**),

(ii) for plates with the opposite charges to those shown on Fig. 4 (label this path **R**).

[3]

(b) Fig. 5 shows another arrangement, similar to the first, but in this case the electron beam continues in a straight line because a magnet (which is not shown) has been placed near the plates.

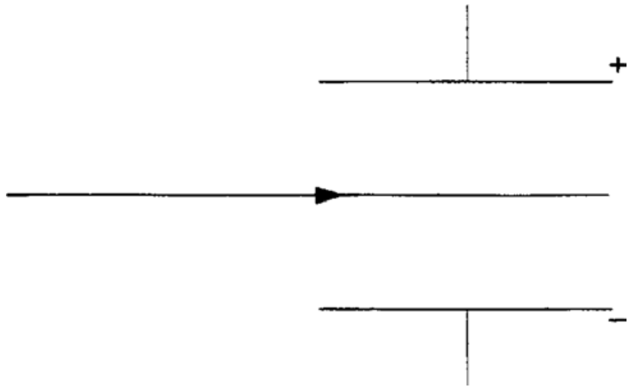


Fig. 5

Explain where you would place the N-pole of the magnet in order to achieve this effect. You may draw on the diagram if you feel that it will make your answer clearer.

....

....

....

....[3]

Extension 2

Fig. 6 shows part of a cathode-ray tube.
An electron beam PQ is entering the region between two horizontal, charged metal plates.

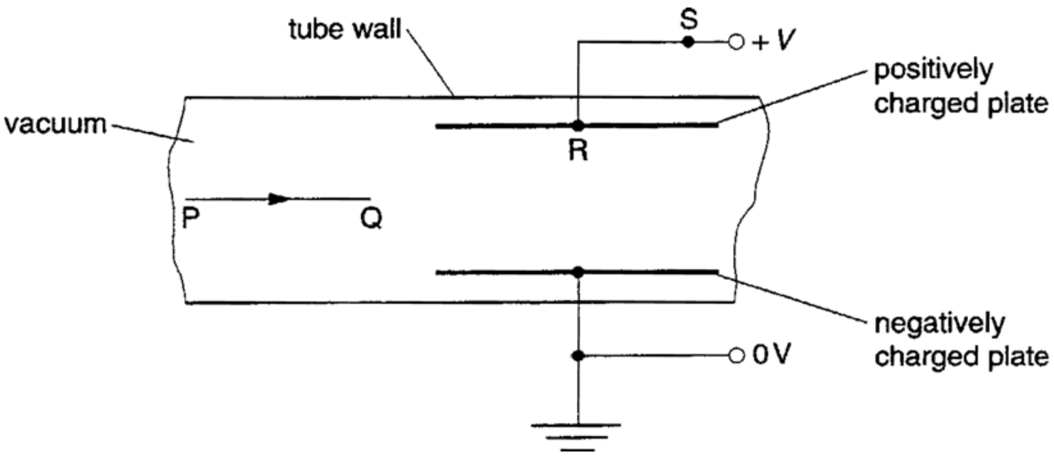


Fig. 6

(a) **(i)** On Fig. 6, draw the electron beam from Q to show its path between the charged plates.

(ii) Explain any change of direction of the electron beam when it is between the charged plates.

....

....

....

(iii) On Fig. 6, show the direction of the conventional current in the electron beam by drawing an arrow and labelling it D.

[5]

(b) The voltage across the plates is increased so that one of the plates collects 10^{14} electrons in 10 s. Each electron carries a charge of 1.6×10^{-19} C.

(i) Calculate the total charge collected by the plate in 1 0 s.

charge= ....

(ii) State an equation linking charge and current. Hence calculate the current in wire RS.

....

current= ....

[4]

Extension 2

(c) Air containing charged dust particles flows between two metal plates. A high potential difference is connected across the plates as illustrated in Fig. 7

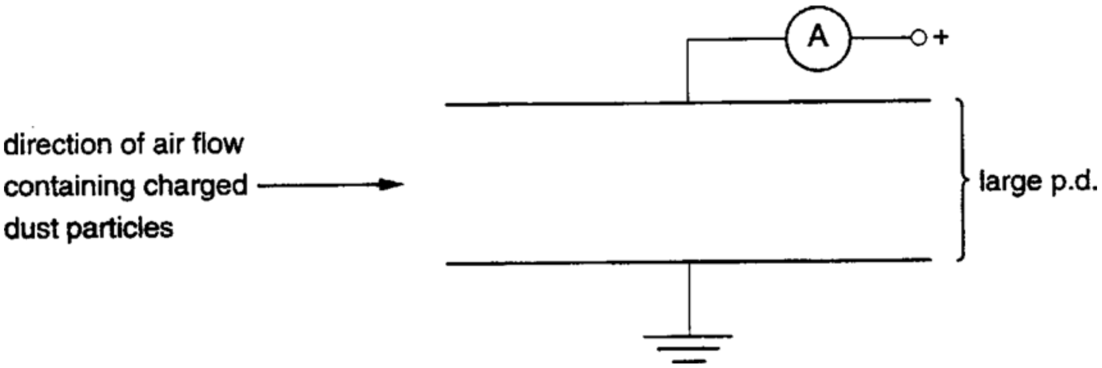


Fig. 7

The charged particles are attracted to the upper plate and move through a potential difference of 10 000 V. The ammeter records a current of 2.1×10^{-6} A.

Calculate

(i) the energy supplied by the voltage source in 10 minutes (600 s),

energy = ...

(ii) the power supplied.

power = ...
[6]

Extension 2

(d) Fig. 8 shows a beam of electrons entering the magnetic field of a coil. This magnetic field is directed into the paper.

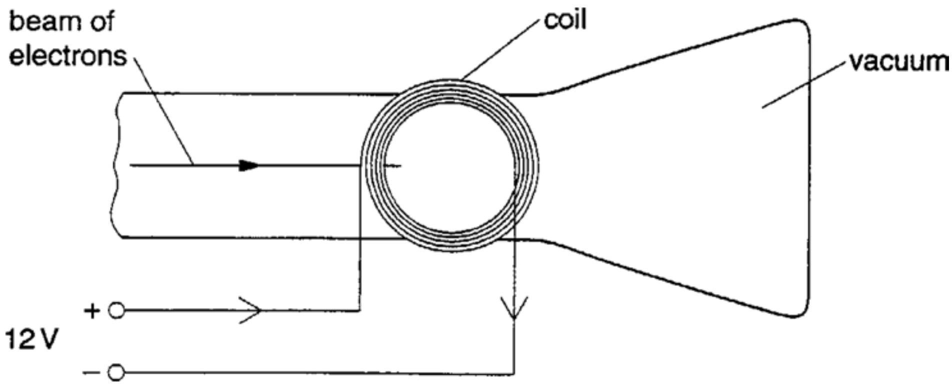


Fig. 8

(i) On Fig. 8, sketch the path of the electron beam until it hits the end of the tube. Explain your choice of path.

....

....

....

....

(ii) The resistance of the coil producing the magnetic field is 100 Ω. Calculate the current in the coil.

current= ....

(iii) State the effect on the electron deflection of increasing **and** reversing the potential difference connected across the coil.

....

....
[7]

Electronics – answers

Core 1

(a) rheostat / potential divider / variable resistor / potentiometer / dimmer

(b) **(i)** 0 (V) or zero or nothing

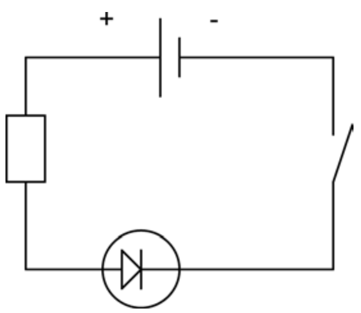
(ii) 12 (V)

(c) idea of increasing brightness as S moves from A to B
appropriate correct comment on resistance or voltage

Alternative to Practical 1

(a) four acceptable (textbook) symbols in series
power-supply polarity labelled and correct diode connection
open switch

e.g.



(b) **(i)** the ammeter should be placed anywhere in series with the other components and with its polarity compatible with the diode connections

(ii) Yes
the current is the same at every point in the circuit

(c) **(i)** I_{max} = 3 / 100 A or 30 mA

(ii) no other resistance in the circuit or 3 volt across 100 Ω or maximum resistance is 100 Ω

Extension 1

(a) **(i)** smooth curve P deviated upwards

(ii) smooth curve R deviated downwards

(b) in front or behind the paper or at right angles to the electric field
the N-pole should be "in front" of the paper to give field lines downwards in to the paper or an explanation in terms of Fleming's rule

Extension 2

(a) **(i)** a smooth curve upwards towards the positive plate

(ii) electrons are negatively charged
unlike charges attract
positive plate attracts electrons

(iii) an arrow pointing towards P anywhere on the line PQRS

(b) **(i)** total charge / s $= 1013 \times 1.6 \times 10^{-19}$
$= 1.6 \times 10^{-6}$ C

(ii) charge = current x time
current $= 1.6 \times 10^{-6} / 1$
$= 1.6 \times 10^{-6}$ A

(c) **(i)** Energy = V I t or V q
$= 10\,000 \times 2.1 \times 600$ J
$= 1.3 \times 10^{7}$ J

(ii) Power = E / t
$= 1.3 \times 10^{7} / 600$
$= 2.1 \times 10^{4}$ W

(d) **(i)** the path should be curved downwards while in the field of the coil in accordance with Fleming's left hand rule

(ii) current = 12 / 100
= 0.12 A

(iii) a bigger deflection in the opposite direction