A Level · OCR · Physics

14 mins 2 questions

Structured Questions

Potential Dividers

Potential Divider Circuits / Variable Resistance Components / Investigating Potential Divider Circuits

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Total Marks /14

1 (a) A light-emitting diode (LED) emits red light when it is positively biased and has a potential difference (p.d.) greater than about 1.8 V.

The energy of a photon of red light is about 1.8 eV.

Calculate the wavelength λ of this red light.

λ = ... m

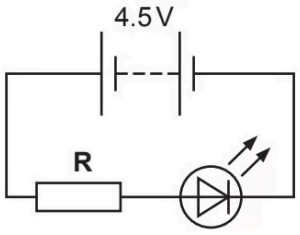
.....

.....

.....

(3 marks)

(b) The LED is connected into a circuit, as shown below.



The battery has electromotive force (e.m.f.) 4.5 V and negligible internal resistance.

The resistor **R** has resistance 150 Ω.

Assume the p.d. across the LED is 1.8 V.

Calculate the ratio $\frac{\text{power dissipated by LED}}{\text{power dissipated by resistor}}$

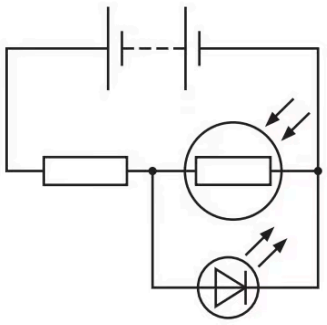
ratio = ...

.....

.....

(2 marks)

(c) The diagram below shows a circuit designed by a student.



The LED is very close to, and facing the light dependent resistor (LDR).

The circuit is taken into a dark room.

i) The student thought that the LED would switch on.

Instead, the LED was found to repeatedly switch on and off.

Explain this behaviour of the LED in this potential divider circuit.

[2]

ii) Suggest a possible refinement so that the LED switches on permanently when taken into the dark room.

[1]

.....

.....

.....

(3 marks)

2 A metal circular plate is rotated at a constant frequency by an electric motor.

The plate has a small hole close to its rim.

Fig. 17.1 shows an arrangement used by a student to determine the frequency of the rotating plate.

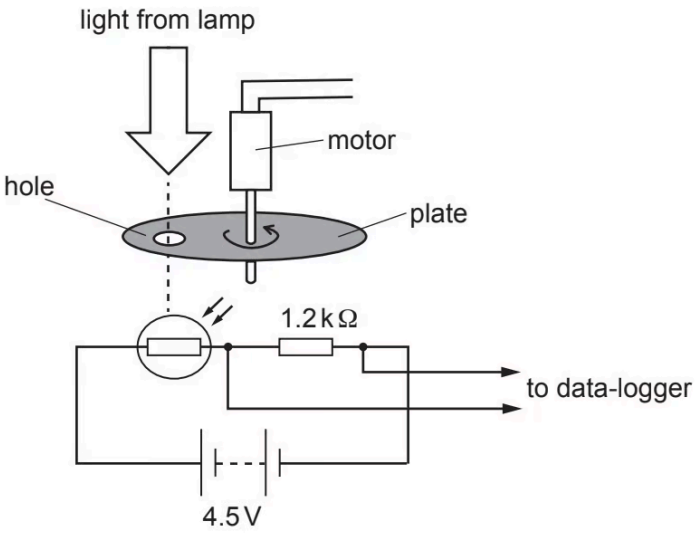


Fig. 17.1

A light-dependent resistor (LDR) and a fixed resistor of resistance 1.2 kΩ are connected in series to a battery. The battery has e.m.f. 4.5 V and has negligible internal resistance. The potential difference *V* across the resistor is monitored using a data-logger. Fig. 17.2 shows the variation of *V* with time *t*.

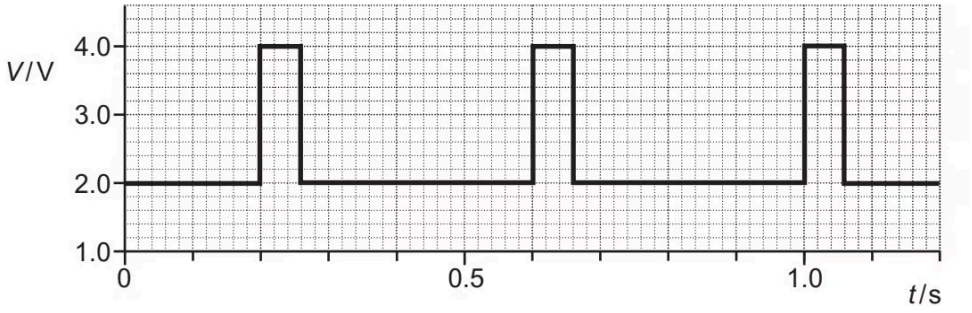


Fig. 17.2

Use your knowledge and understanding of potential divider circuits to explain the shape of the graph shown in Fig. 17.2. Include in your answer the maximum and minimum values of the resistance of the LDR.

Describe how the student can determine the frequency of the rotating plate.

(6 marks)