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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

Uses of an Oscilloscope

Paper 2 — Theory Worksheet (topical compilation)

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The City School

PAF CHAPTER

P2 Worksheet

INTRODUCTORY ELECTRONICS

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QUESTION # 1: M/J 16 P21 Q9

Fig. 9.1 shows a cathode-ray oscilloscope (c.r.o.). An alternating voltage supply is applied to the input and the trace produced is shown.

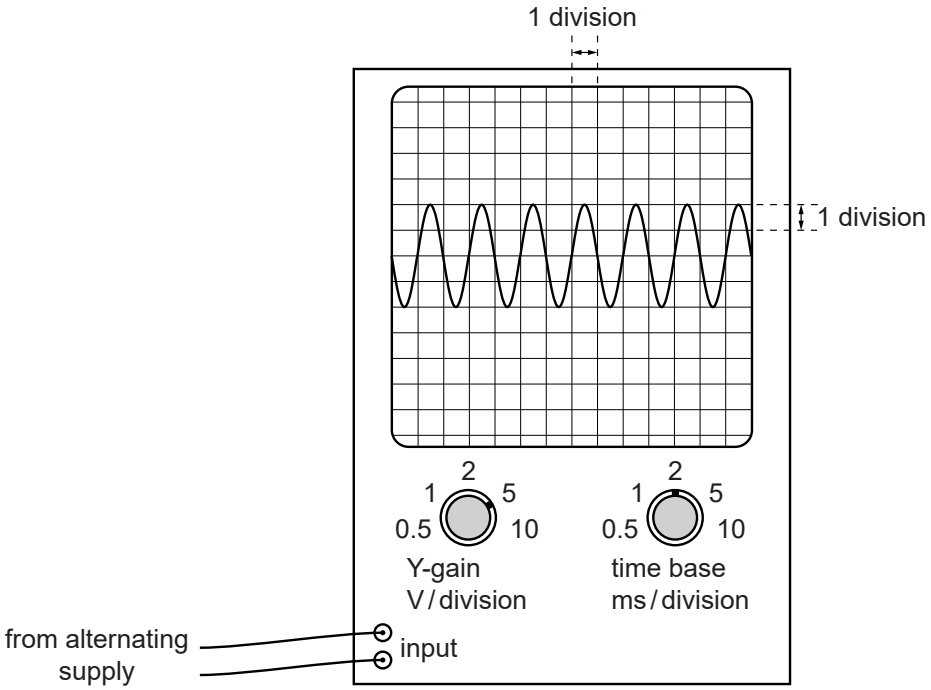


Fig. 9.1

(a) Use Fig. 9.1 to determine the maximum voltage of the supply.

voltage = ... [2]

(b) Describe how the trace on the screen and the controls on the c.r.o. are used to measure the time between any two points on the trace.

.....

.....

.....

.....[2]

(c) Use Fig. 9.1 to determine the frequency of the supply.

frequency = ... [2]

QUESTION # 2: M/J 16 P22 Q10

(a) Fig. 10.1 shows the basic structure of a cathode-ray oscilloscope (c.r.o.).

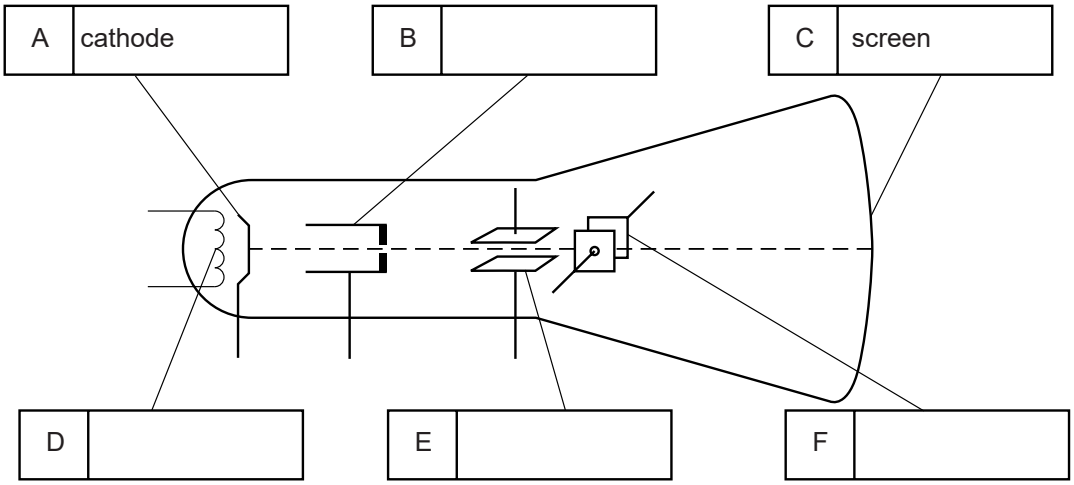


Fig. 10.1

Electrons strike the middle of the screen and a bright spot is produced.

(i) On Fig. 10.1, write the names of parts B, D, E and F in the spaces provided. [3]

(ii) State the purpose of

1. part B,

.....

.....[1]

2. part D.

.....

.....[1]

(b) A microphone is connected to a c.r.o. to display a sound wave.

Fig. 10.2 shows the trace on the c.r.o.

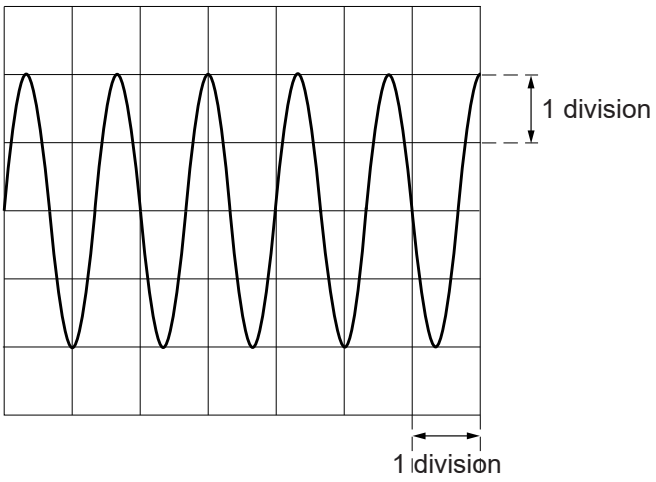


Fig. 10.2

The settings on the c.r.o. are: Y-gain 0.5 V / division; time base 2.0 ms / division.

(i) Determine

1. the maximum voltage,

voltage = ...[1]

2. the time for one oscillation,

time = ...[2]

3. the frequency of the sound wave.

frequency = ...[2]

(ii) The settings of the c.r.o. remain the same. On Fig. 10.2, sketch the trace of a sound wave with a smaller amplitude and a lower frequency. [2]

QUESTION # 3:M/J 19 P22 Q8

Fig. 8.1 shows a device that is used to show the force on an electron in an electric field.

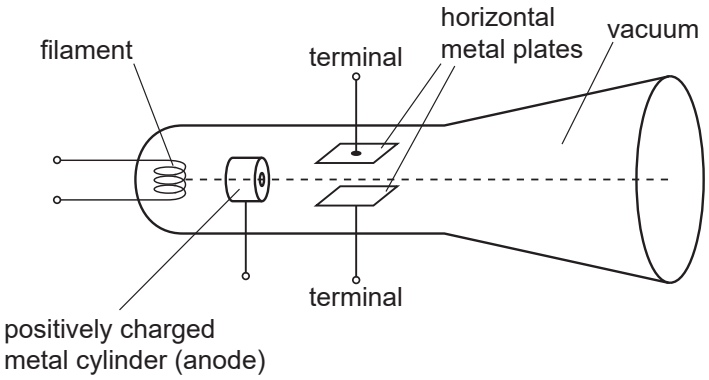


Fig. 8.1

(a) Explain how a continuous flow of electrons from the filament is produced in this apparatus.

.....

.....

.....

.....

..... [2]

(b) When an electron is in an electric field there is a force on the electron.

The direction of this force is in the opposite direction to the electric field.

Describe how the metal plates in Fig. 8.1 can be used to show this.

.....

.....

.....

.....

..... [2]

QUESTION # 4: M/J 20 P22 Q10

An oscilloscope is a device used to display waveforms.

(a) Inside the oscilloscope, a beam of electrons is emitted from a metal filament by thermionic emission.

The emitted electrons are accelerated away from the filament by a potential difference of 2000 V.

(i) State what must happen to the metal filament for thermionic emission to occur.

.....

..... [1]

(ii) Explain why the electrons accelerate away from the filament.

.....

.....

..... [1]

(iii) The charge on one electron is 1.6×10^{-19} C.

Calculate the maximum kinetic energy of one electron after it has been accelerated through 2000 V.

kinetic energy = ... [2]

(b) Fig. 10.1 is the trace on the screen of the oscilloscope.

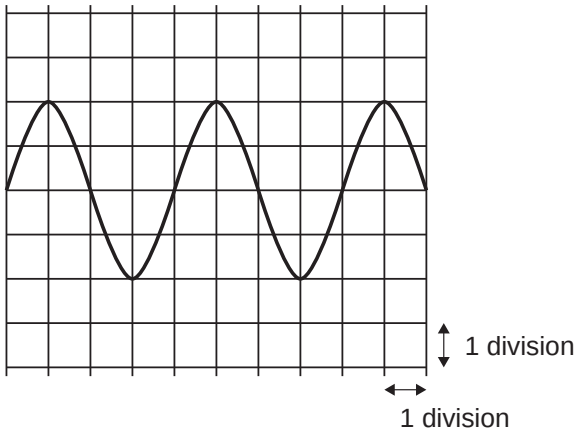


Fig. 10.1

The settings on the oscilloscope are 10 ms / division for the *x*-axis and 3.0 V / division for the *y*-axis.

(i) Calculate the amplitude of the trace shown in Fig. 10.1.

amplitude = ... [2]

(ii) Calculate the time for one oscillation (complete wavelength) of the trace shown in Fig. 10.1.

time = ... [1]

(d) A student investigates what happens when a diode is connected between the microphone and the oscilloscope.

Fig. 10.2 shows the circuit that he uses.

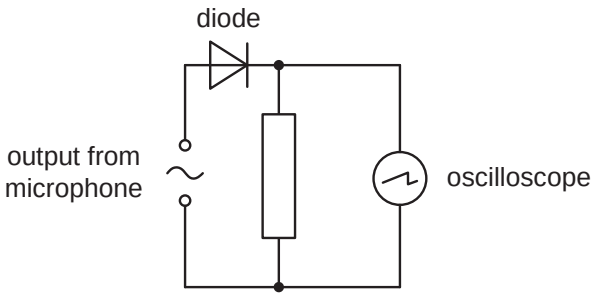


Fig. 10.2

Without the diode, the output from the microphone is an alternating current and the trace is as shown in Fig. 10.1 on page 18.

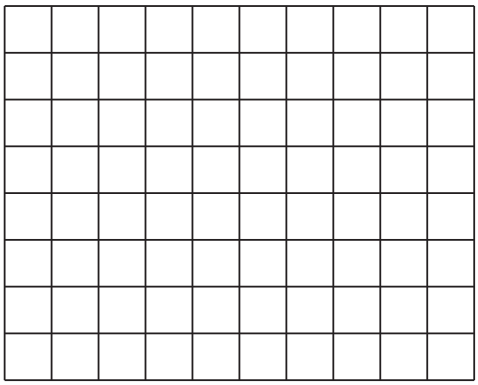
(i) Describe the action of the diode on the current from the microphone.

.....

..... [1]

(ii) On the grid in Fig. 10.3, sketch the trace seen on the screen when the diode is used.

Fig. 10.3



[2]

QUESTION # 5: M/J 16 P22 Q9

(e) A resistor is shown in Fig. 9.2 and part of the resistor colour code is shown in Fig. 9.3.

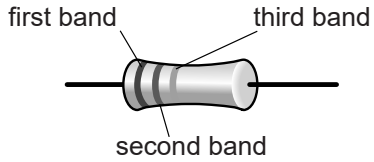


Fig. 9.2

digit or multiplier	colour
0	black
1	brown
2	red
3	orange

Fig. 9.3

State the colour of the bands on the 30 Ω resistor.

first band = ...

second band = ...

third band = ...

[2]

QUESTION # 4: O/N 14 P42 Q3

3 (a) A student is given two resistors of resistance 24 Ω and 24 kΩ. Each resistor is marked with three coloured bands.

Fig. 3.1 shows the resistor colour code.

black	0
brown	1
red	2
orange	3
yellow	4
green	5
blue	6
violet	7
grey	8
white	9

Fig. 3.1

State the colours of the bands on the resistors given to the student.

	first band	second band	third band
24 Ω	.....	.....	.....
24 kΩ	.....	.....	.....

[2]

QUESTION # 6: M/J 16 P21 Q8

8 Fig. 8.1 shows a circuit that contains a battery, a fixed resistor of resistance 1000 Ω and a variable resistor R.

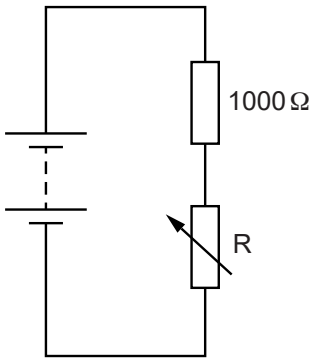


Fig. 8.1

(a) (i) State the relationship between the current I_B in the battery, the current I_1 in the fixed resistor and the current I_2 in the variable resistor.

.....

.....[1]

(ii) State an equation that relates the potential difference (p.d.) V_B across the battery, the p.d. V_1 across the fixed resistor and the p.d. V_2 across the variable resistor.

.....

.....[1]

(b) The p.d. across the battery is 9.0 V. The resistance of R is set at 500 Ω.

Calculate the current in R.

current = ...[2]

QUESTION # 7: M/J 19 P21 Q8

8 Fig. 8.1 shows a circuit diagram containing a 2000 Ω resistor of constant resistance and a thermistor.

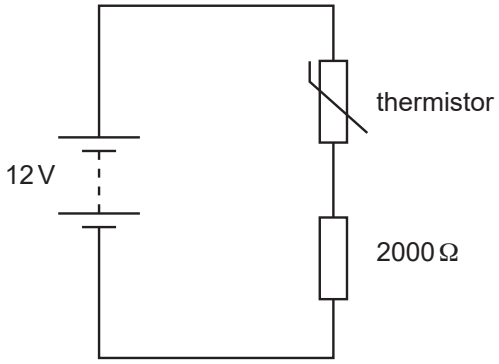


Fig. 8.1

(a) (i) At one temperature, the resistance of the thermistor is 1200 Ω.

Calculate the potential difference (p.d.) across the 2000 Ω resistor at this temperature.

p.d. = ... [2]

(ii) Explain why the p.d. across the 2000 Ω resistor increases when the temperature increases.

.....

.....

.....

..... [2]

QUESTION # 8: O/N 19 P22 Q6

6 An electric circuit contains a 700 Ω resistor and a light-dependent resistor (LDR). Fig. 6.1 is the circuit diagram.

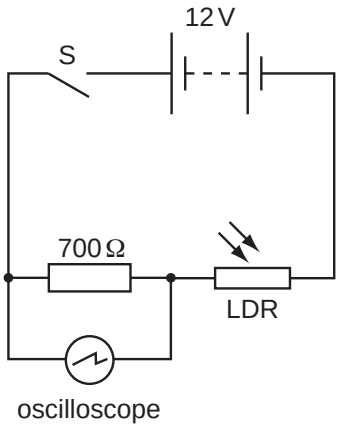


Fig. 6.1

The electromotive force (e.m.f.) of the battery is 12 V.

An oscilloscope is connected across the fixed resistor. Fig. 6.2 shows the oscilloscope, including the settings of the timebase and the Y-gain controls. Line Q shows the position of the trace on the oscilloscope when the switch S is open.

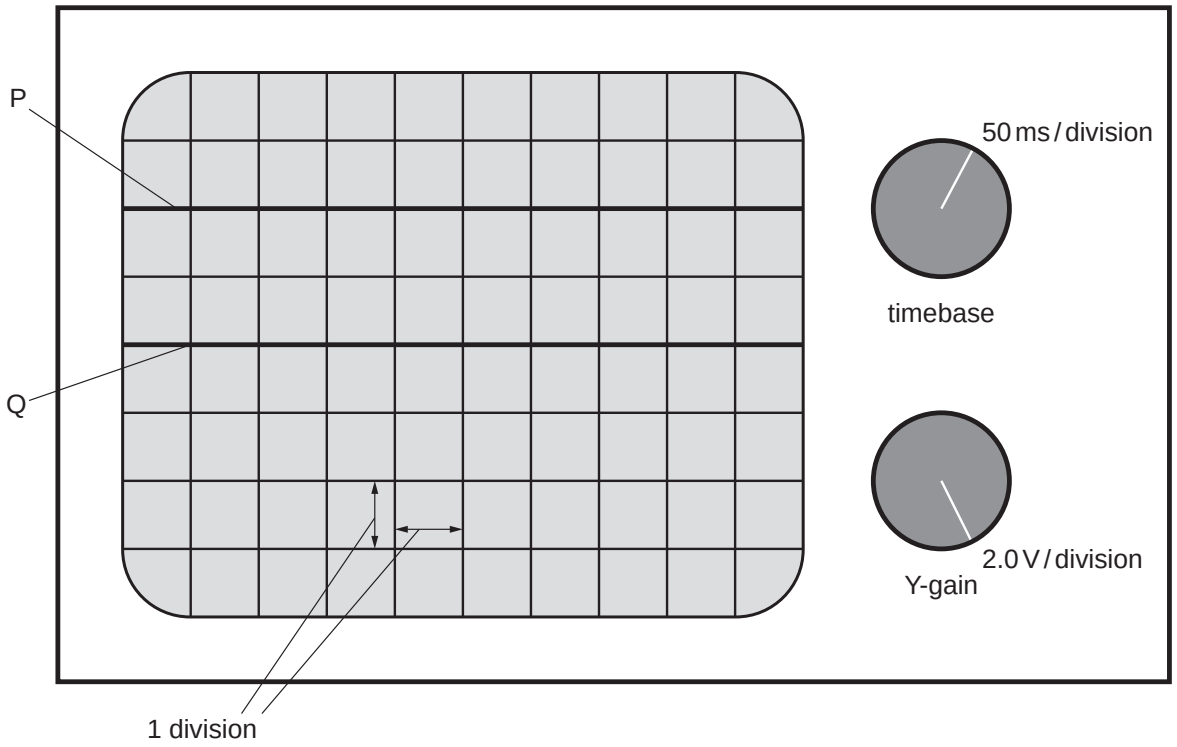


Fig. 6.2

The switch S is closed and the trace on the oscilloscope moves to the position shown by line P in Fig. 6.2.

(a) **(i)** Determine the potential difference (p.d.) across the 700 Ω resistor.

p.d. = ... [1]

(ii) Determine the resistance of the LDR.

resistance = ... [3]

(b) The intensity of the light incident on the LDR gradually increases.

State and explain how the trace on the oscilloscope screen moves.

.....

.....

.....

..... [3]

QUESTION # 9: M/J 20 P21 Q8

(d) Fig. 8.3 shows a relay used to switch on a car headlamp.

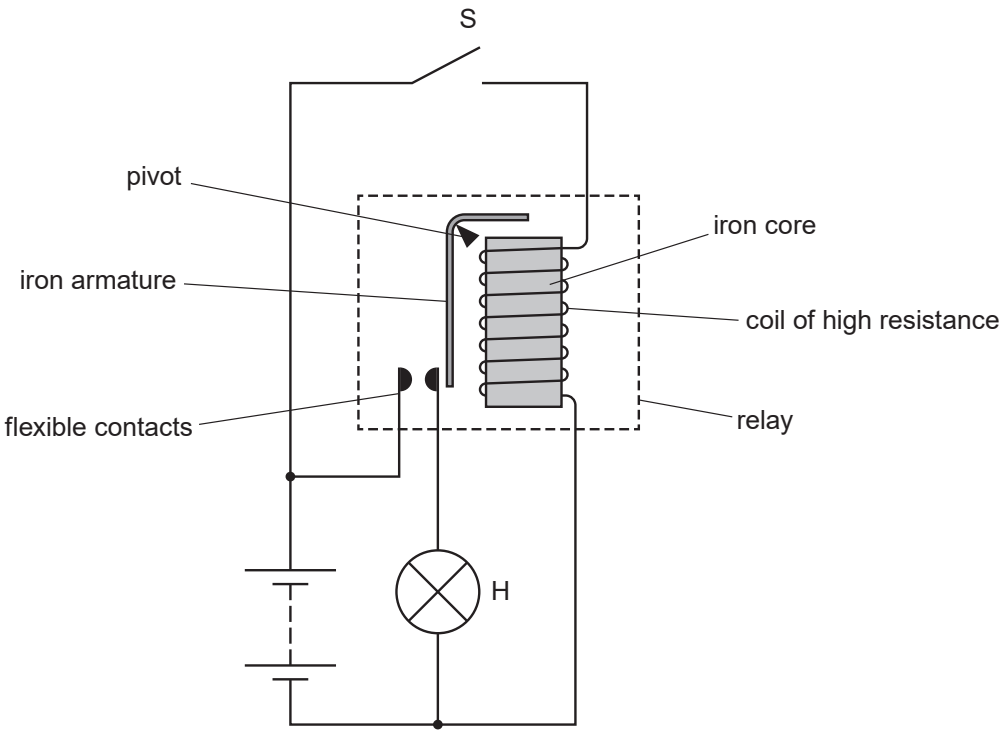


Fig. 8.3

Explain why headlamp H lights up when switch S is closed.

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.....

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.....

.....

..... [4]

QUESTION # 10: M/J 20 P22 Q9

9 **(a)** Fig. 9.1 shows a simple relay used to switch a mains electric motor on and off.

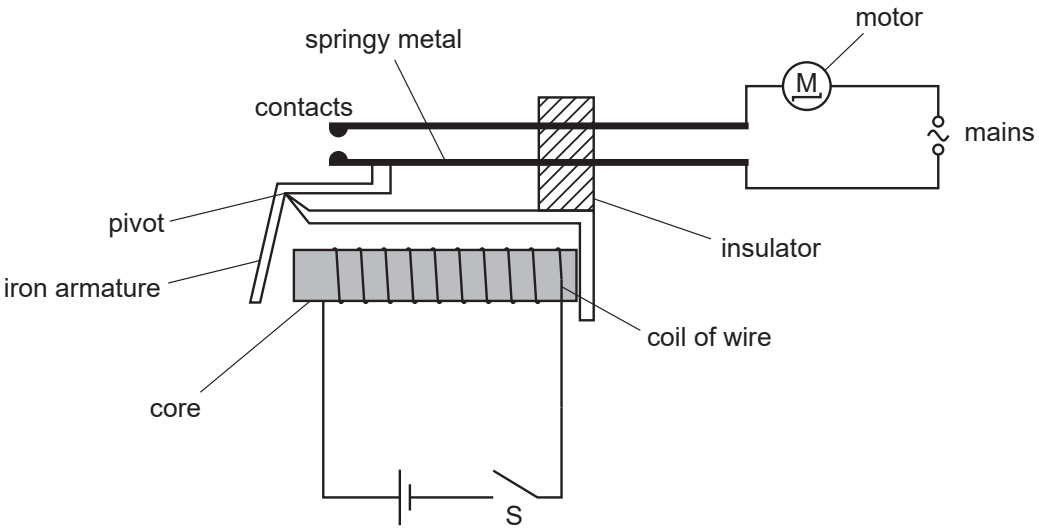

Fig. 9.1

(i) Explain why the motor switches on when switch S is closed.

.....

.....

.....

..... [3]

(ii) Explain why the core is made of iron rather than steel.

.....

.....

..... [2]

(iii) A student suggests that the motor can be turned on and off without a relay.

He suggests connecting the mains to a simple switch in series with the motor.

Suggest **one** reason why, in some situations, using the relay is better.

.....

..... [1]

QUESTION # 11: M/J 19 P21 Q8

(b) The circuit in Fig. 8.1 can be adapted to enable a lamp to switch on and off automatically.

Fig. 8.2 shows the circuit adapted using a relay and Fig. 8.3 shows the circuit adapted using a transistor.

In both cases, the lamp switches on when the temperature of the thermistor increases.

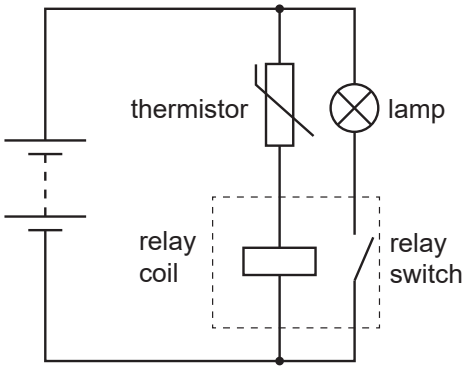

Fig. 8.2

EITHER

Describe what happens inside the relay in Fig. 8.2 that causes the lamp to switch on.

.....

.....

.....

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