*IB PHYSICS*

Name: _____

Period: _____ Date: _____

# Marks: **63** Raw Score: ____ IB Curve: ____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

# CHAPTER 5 TEST REVIEW

**1.** The electronvolt is a unit of

A. force.

B. potential difference.

C. energy.

D. electric field strength.

**(Total 1 mark)**

**2.** Which of the following is a correct unit of electromotive force (emf)?

A. $A\ \Omega^{-1}$

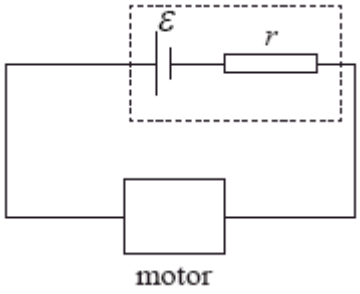
B. $\Omega\ A^{-1}$

C. $C\ J^{-1}$

D. $J\ C^{-1}$

**(Total 1 mark)**

**3.** A cell of emf ε and internal resistance *r* delivers current to a small electric motor.




450 C of charge flows through the motor and 9000 J of energy are converted in the motor. 1800 J are dissipated in the cell. The emf of the cell is

A. 4.0 V.

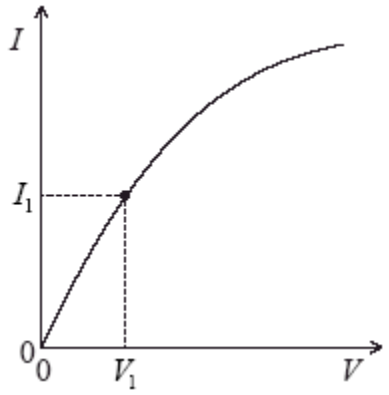
B. 16 V.

C. 20 V.

D. 24 V.

**(Total 1 mark)**

**4.** The graph shows how the current $I$ in a resistor varies with the voltage $V$ applied across it.




Which of the following gives the resistance of the resistor, when $I = I_1$?

A. $\frac{V_1}{I_1}$

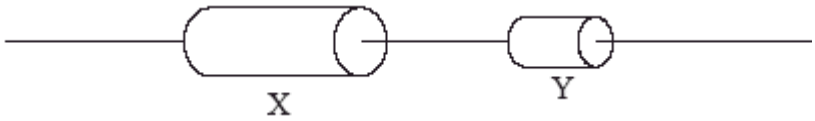
B. The slope of the curve at the point $(V_1, I_1)$

C. $\frac{I_1}{V_1}$

D. The inverse of the slope of the curve at the point $(V_1, I_1)$

**(Total 1 mark)**

**5.** Two resistors, made of the same material, are connected in series to a battery. The length of resistor X is twice that of resistor Y, and X has twice the cross-sectional area of Y.




Which of the following gives $\frac{\text{resistance of X}}{\text{resistance of Y}}$?

A. $\frac{1}{4}$

B. $\frac{1}{2}$

C. 1

D. 4

**(Total 1 mark)**

**6.** Two rectangular blocks, $X$ and $Y$, of the same material have different dimensions but the same overall resistance. Which of the following equations is correct?

A. resistivity of $X$ × length of $X$ = resistivity of $Y$ × length of $Y$

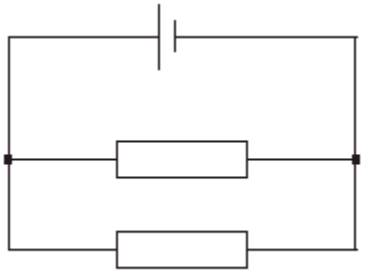
B. $\frac{\text{length of } X}{\text{cross sectional area of } X} = \frac{\text{length of } Y}{\text{cross sectional area of } Y}$

C. resistivity of $X$ × cross sectional area of $X$ = resistivity of $Y$ × cross sectional area of $Y$

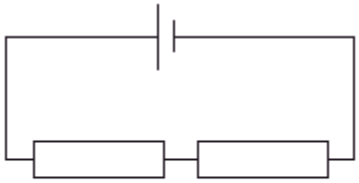
D. $\frac{\text{length of } X}{\text{cross sectional area of } Y} = \frac{\text{length of } Y}{\text{cross sectional area of } X}$

**(Total 1 mark)**

**7.** In the circuits below the cells have the same emf and zero internal resistance. The resistors all have the same resistance.



circuit X



circuit Y

Which of the following gives the ratio $\frac{\text{power dissipated in X}}{\text{power dissipated in Y}}$?

A. $\frac{1}{4}$

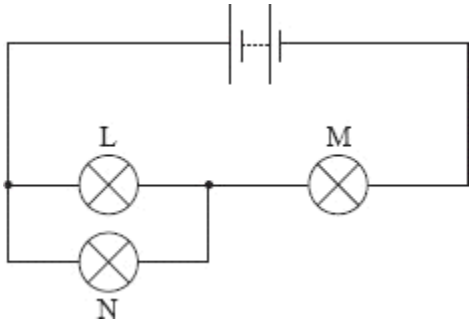
B. $\frac{1}{2}$

C. 2

D. 4

**(Total 1 mark)**

**8.** In the circuit below, the battery has negligible internal resistance. Three identical lamps L, M and N of constant resistance are connected as shown.

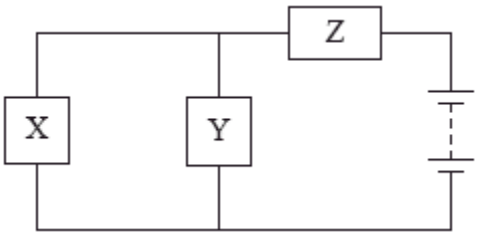



The filament of lamp N breaks. Which of the following shows the subsequent changes to the brightness of lamp L and lamp M?

| | Lamp L | Lamp M |
|---|---|---|
| A. | stays the same | decreases |
| B. | increases | stays the same |
| C. | increases | decreases |
| D. | decreases | increases |

**(Total 1 mark)**

**9.** Three identical resistors are connected to a battery as shown.




Which of the following is a correct statement?

A. The current through X is greater than that through Z.

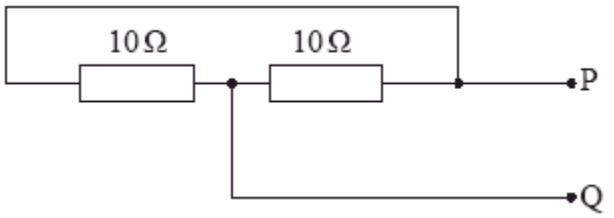
B. The potential difference across Z is greater than that across Y.

C. The potential difference across resistor X and Y together is the same as that across Z.

D. The current through Z is less than the total current through X and Y.

**(Total 1 mark)**

**10.** Two 10 Ω resistors are connected as shown.




What is the resistance across PQ?

A. 0 Ω

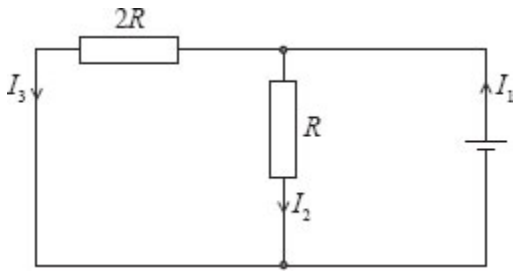
B. 5 Ω

C. 10 Ω

D. 20 Ω

**(Total 1 mark)**

**11.** In the circuit shown below, the cell has negligible internal resistance.




Which of the following equations is correct?

A. $I_1 = 2I_2$

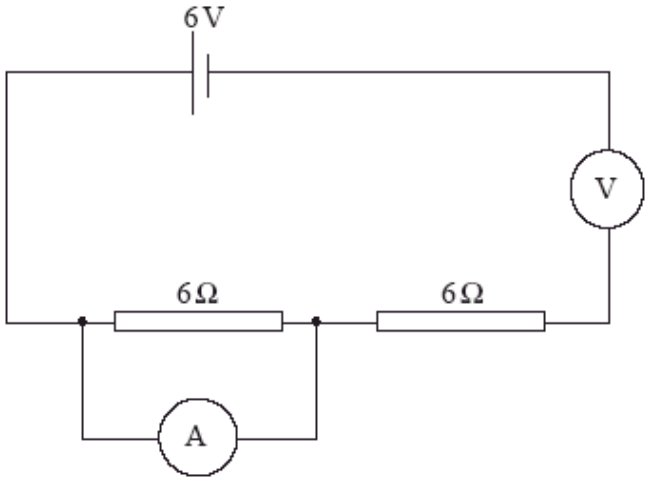
B. $I_1 = 2I_3$

C. $I_2 = 2I_3$

D. $I_3 = 2I_1$

**(Total 1 mark)**

**12.** Two 6 Ω resistors are connected in series with a 6 V cell. A student **incorrectly** connects an ammeter and a voltmeter as shown below.

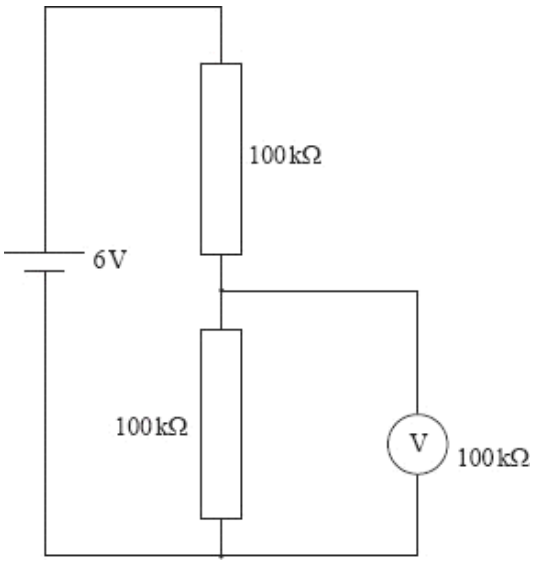



The readings on the ammeter and on the voltmeter are

| | Ammeter reading / A | Voltmeter reading / V |
|---|---|---|
| A. | 0.0 | 0.0 |
| B. | 0.0 | 6.0 |
| C. | 1.0 | 0.0 |
| D. | 1.0 | 6.0 |

**(Total 1 mark)**

**13.** In the circuit below, the voltmeter has a resistance 100 kΩ. The battery has negligible internal resistance and emf 6 V.




The reading on the voltmeter is

A. 0 V.

B. 2 V.

C. 3 V.

D. 4 V.

**(Total 1 mark)**

**14.** This question is about electric charge and resistance.

(a) A plastic rod XY is held at end X. The end Y is rubbed with a piece of cloth and, as a result, the end Y becomes electrically charged.

The procedure is now repeated using a copper rod and it is found that the copper rod remains electrically neutral. Explain these observations in terms of the properties of conductors and insulators.

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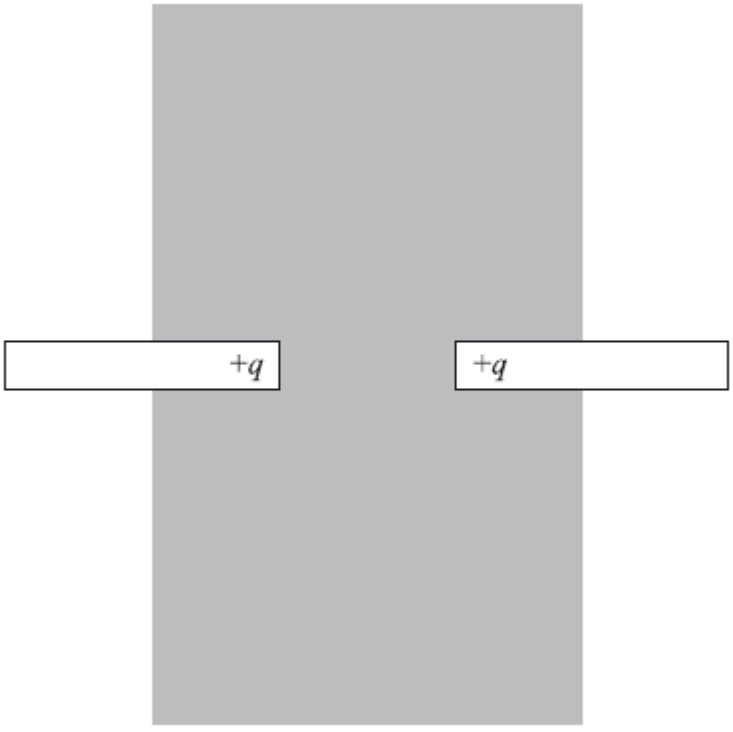
(b) Two plastic rods each have a positive charge $+q$ situated at one end. The rods are arranged as shown.




Assume that the charge at the end of each rod behaves as a point charge. Draw, in the shaded area on the diagram

(i) the electric field pattern due to the two charges.

**(2)**

(ii) a line to represent an equipotential surface. Label the line with the letter V.

**(1)**

(c) A resistor of resistance 1.5 Ω is made from copper wire of radius 0.18 mm. The resistivity of copper is $1.7 \times 10^{-8}$ Ω m. Determine the length of copper wire used to make the resistor.

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(d) The manufacturer of the resistor in (c) guarantees that the resistance is within 10 % of 1.5 Ω , provided that the power dissipation in the resistor does not exceed 1.0 W.

(i) Suggest why the resistance of the resistor might be greater than 1.65 Ω if the power dissipation in the resistor is greater than 1.0 W.

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(ii) Show that, for a power dissipation of 1.0 W, the current in a resistor of resistance 1.5 Ω is 0.82 A.

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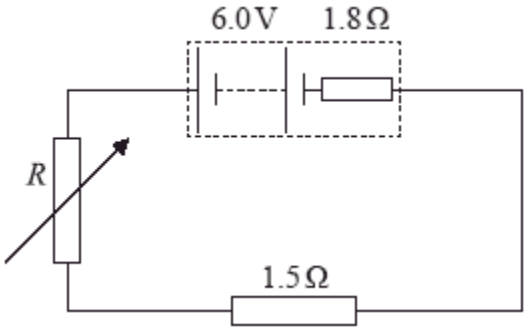
(iii) The 1.5 Ω resistor is connected in series with a variable resistor and battery of emf 6.0 V and internal resistance 1.8 Ω.




Estimate the resistance *R* of the variable resistor that will limit the current to 0.82 A.

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**15.** This question is about electric circuits.

(a) Define

(i) *electromotive force* (emf ) of a battery.

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(ii) *electrical resistance* of a conductor.

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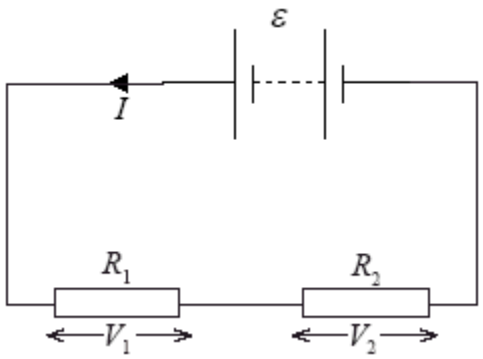
(b) A battery of emf ε and negligible internal resistance is connected in series to two resistors. The current in the circuit is *I*.




(i) State an equation giving the total power delivered by the battery.

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**(1)**

(ii) The potential difference across resistor $R_1$ is $V_1$ and that across resistor $R_2$ is $V_2$. Using the law of the conservation of energy, deduce the equation below.

$$\varepsilon = V_1 + V_2$$

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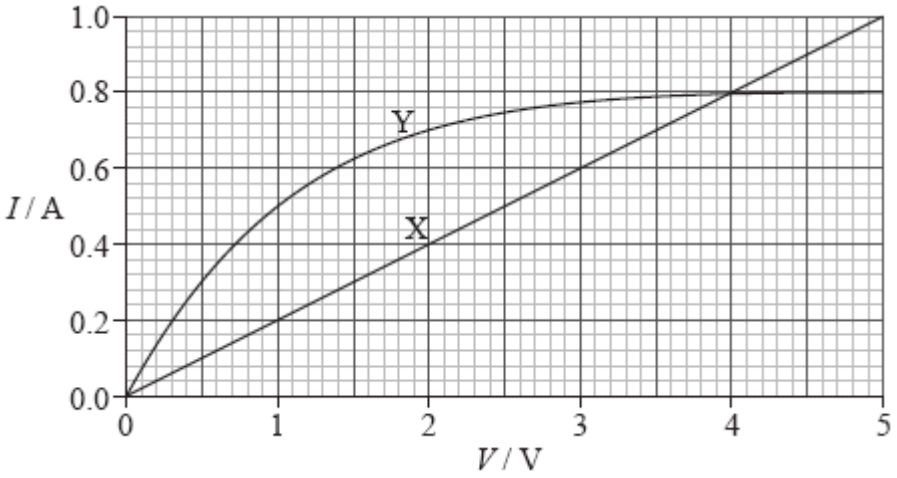
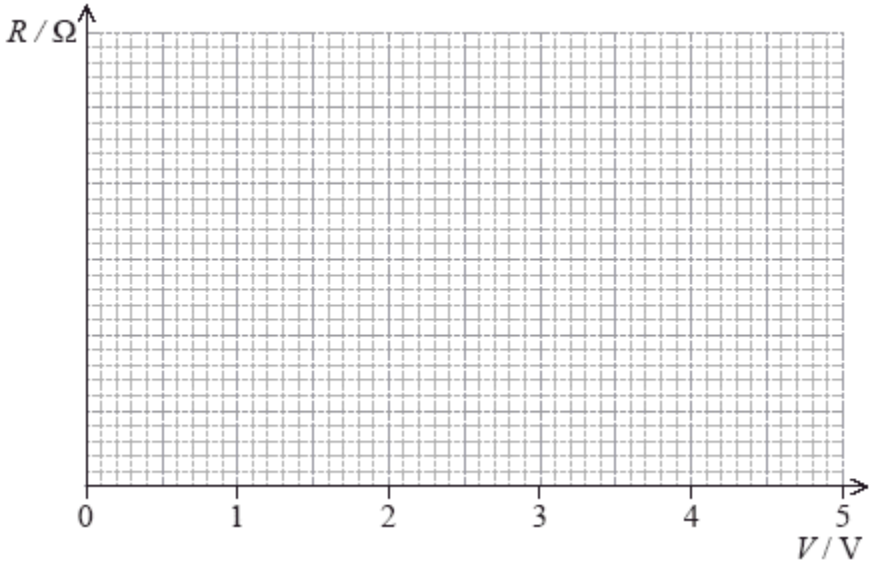
(c) The graph shows the *I*-*V* characteristics of two conductors, X and Y.




On the axes below, sketch graphs to show the variation with potential difference *V* of the resistance of conductor X (label this graph X) and conductor Y (label this graph Y).
You do not need to put any numbers on the vertical axis.

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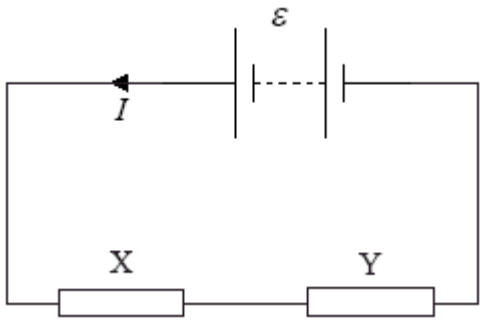
(d) The conductors in (c) are connected in series to a battery of emf $\varepsilon$ and negligible internal resistance.




The power dissipated in each of the two resistors is the same.

Using the graph given in (c),

(i) determine the emf of the battery.

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(ii) calculate the total power dissipated in the circuit.

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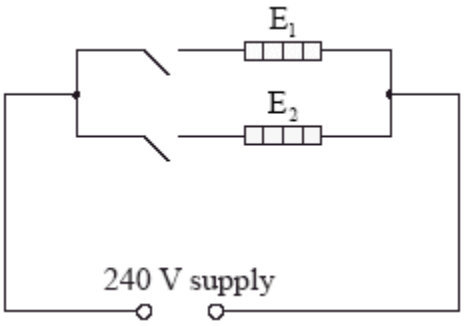
**(2)**

**16.** This question is about an electrical heater.

An electrical heater consists of two heating elements $E_1$ and $E_2$. The elements are connected in parallel. Each element has a switch and is connected to a supply of emf 240 V. The supply has negligible internal resistance.




Element $E_1$ is made from wire that has a cross-sectional area of $6.8 \times 10^{-8}$ m$^2$. The resistivity of the wire at the operating temperature of the element is $1.1 \times 10^{-6}$ Ωm.

(a) (i) The total length of wire is 4.5 m. Show that the resistance of $E_1$ is 73 Ω.

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(ii) Calculate the power output of $E_1$ with only this element connected to the supply.

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(iii) Element $E_2$ is made of wire of the same cross-section and material as $E_1$. The length of wire used to make $E_2$ is 1.5 m. Determine the total power output when both $E_1$ and $E_2$ are connected to the supply.

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(iv) With reference to the power output, explain why it would be inappropriate to connect the heating elements in series.

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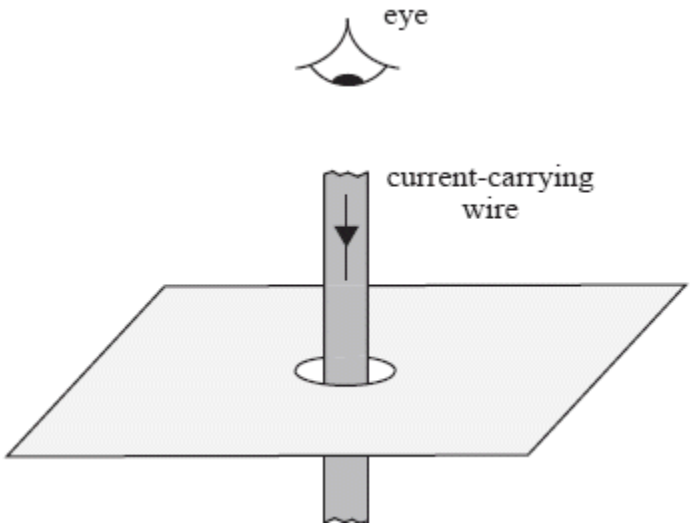
(b) Each element in the electrical heater is wound as a coil as shown.

Each turn of the coil may be considered to act as a current-carrying long straight wire.

(i) On the diagram, draw the magnetic field around a current-carrying long straight wire. The arrow shows the direction of the current.




**(3)**

(ii) State **and** explain whether the turns of wire will attract or repel one another.

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**(3)**

**17.** This question is about electrical resistance.

(a) A heating coil is to be made of wire of diameter $3.5 \times 10^{-4}$ m. The heater is to dissipate 980 W when connected to a 230 V d.c. supply. The material of the wire has resistivity $1.3 \times 10^{-6}$ Ω m at the working temperature of the heater.

(i) Define *electrical resistance*.

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**(1)**

(ii) Calculate the resistance of the heating coil at its normal working temperature.

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**(2)**

(iii) Show that the length of wire needed to make the heating coil is approximately 4 m.

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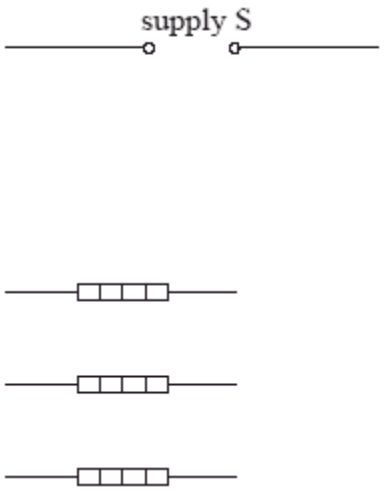
**(2)**

(b) Three identical electrical heaters each provide power *P* when connected separately to a supply S which has zero internal resistance. On the diagram below, complete the circuit by drawing **two** switches so that the power provided by the heaters may be **either** *P* **or** 2*P* **or** 3*P*.




**(2)**