

Revision Sheet

A-Level Physics · Unit 9 Electricity

10 vocabulary items · 28 marks of exam questions (14 questions)

Part 1 · Vocabulary review (10 items). The terms this unit is examined on most. Mark it yourself from the answer key.

Section A · Chinese to English

Write the English word.

1.

[1]
2.

[1]
3.

[1]
4.

[1]
5.

[1]
6.

[1]
7.

[1]
8.

[1]
9.

[1]
10.

[1]

Part 2 · Exam questions (28 marks, 14 questions) begins on the next page. They are ordered easy to difficult and none of them has been set before.

11 A piece of wire X has resistivity ρ , length L and cross-sectional area A . Wire X has a resistance R .

A second piece of wire Y is made of a different metal. It has the same resistance as X but has twice the length of X.

Which row gives possible values for the resistivity and the cross-sectional area of Y?

	resistivity	cross-sectional area
A	$\frac{1}{2}\rho$	$\frac{1}{2}A$
B	$\frac{1}{2}\rho$	A
C	ρ	$\frac{1}{2}A$
D	2ρ	A

12 A sample of material has cross-sectional area A and length L . The temperatures at the two sides of the sample are T_1 and T_2 . Thermal energy Q is transferred through the sample in time t .

These quantities are related by

$$\frac{Q}{t} = \frac{k \times A \times (T_1 - T_2)}{L}$$

where k is a constant.

What are the SI base units of k ?

- A $\text{kg m s}^{-3} \text{ }^\circ\text{C}^{-1}$ B $\text{kg m s}^{-3} \text{ K}^{-1}$ C $\text{kg m s}^{-1} \text{ }^\circ\text{C}^{-1}$ D $\text{kg m s}^{-1} \text{ K}^{-1}$

13 A wire of diameter d is connected into an electric circuit. There is a current I in the wire and the charge carriers have an average drift speed v .

The wire is replaced with a new wire of the same material but with a diameter $0.5d$.

The current is adjusted so that the charge carriers in the new wire have an average drift speed $3v$.

What is the current in the new wire?

- A $0.75I$ B $1.5I$ C $6I$ D $12I$

14 What is the definition of potential difference across a component?

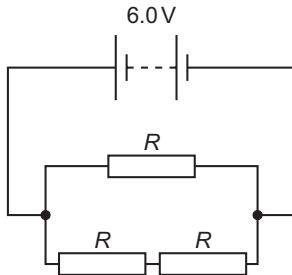
- ☐ **A** energy transferred per unit charge
- B** energy transferred per unit current
- C** energy transferred per unit distance
- D** energy transferred per unit time

15 A radioactive source produces a beam of α -particles in a vacuum. The average current caused by the α -particles in the beam is 1.5×10^{-9} A.☐

The beam is incident on a metal target.

What is the average number of α -particles hitting the metal target in a time of 3.0 s?

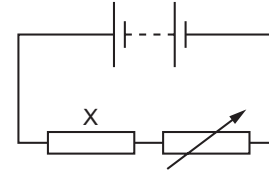
- A** 4.7×10^9 **B** 9.4×10^9 **C** 1.4×10^{10} **D** 2.8×10^{10}

16 In the circuit shown, the battery has an electromotive force (e.m.f.) of 6.0 V and negligible internal resistance.☐The three resistors each have resistance R .

The total power dissipated in the resistor network is 24 W.

What is the value of R ?

- A** 0.50Ω **B** 1.0Ω **C** 1.5Ω **D** 2.3Ω

17 In the circuit shown, a fixed resistor X is connected in series with a battery and a variable resistor.☐

The power dissipated in resistor X is 7.2 W when a current of 3.0 A passes through it.

The variable resistor is adjusted so that the power dissipated in X increases by 50%.

What is the new current in the circuit?

- A** 2.4 A **B** 3.7 A **C** 4.5 A **D** 14 A

18 A power supply is connected to a component by connecting wires of total resistance 4.9Ω .☐

The power supply has an output power of 3.6 W and a terminal potential difference of 12 V.

How much thermal energy is dissipated in the connecting wires in a time of 1.0 hour?

- A** 0.44 J **B** 29 J **C** 1.6 kJ **D** 11 kJ

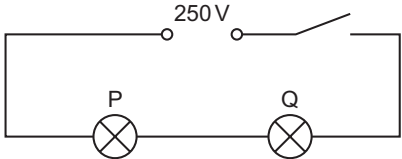
19 What is the definition of the potential difference (p.d.) across a component?☐

- A** the electrical power supplied to the component
- B** the energy transferred to the component per unit charge
- C** the product of the current in the component and its resistance
- D** the voltage across the component

20 A resistor has resistance R . When the potential difference (p.d.) across the resistor is V , the current in the resistor is I . The power dissipated in the resistor is P . Work W is done when charge Q flows through the resistor.☐What is **not** a valid relationship between these variables?

- A** $I = \frac{P}{V}$ **B** $Q = \frac{W}{V}$ **C** $R = \frac{P}{I^2}$ **D** $R = \frac{V}{P}$

21 In the circuit shown, lamp P is rated 250 V, 50 W and lamp Q is rated 250 V, 200 W. The two lamps are connected in series to a 250 V power supply.



- Assume that the resistance of each lamp remains constant.
- Which statement most accurately describes what happens when the switch is closed?
- A Lamp P emits four times as much power as lamp Q.
 - B Lamp P emits twice as much power as lamp Q.
 - C Lamp Q emits four times as much power as lamp P.
 - D Lamp Q emits twice as much power as lamp P.

22 Which values of current and resistance will produce a rate of energy transfer of 16 J s^{-1} ?

	current/A	resistance/ Ω
A	1	4
B	2	2
C	2	8
D	4	1

23 (a) The current in a filament lamp decreases.

State and explain how the resistance of the lamp changes.

.....

..... [1]

(b) A cylindrical wire has length L and resistance R . The **total** number of free electrons (charge carriers) contained in the volume of the wire is N . Each free electron has charge e . The potential difference between the ends of the wire is V .

Determine expressions, in terms of some or all of the symbols e , L , N , R and V for:

(i) the current in the wire

current = [1]

(ii) the average drift speed of the free electrons

average drift speed = [2]

(iii) the average time taken for a free electron to move along the full length of the wire.

time taken = [1]

[Total: 5]

24 (a) State Kirchhoff's second law.

.....

 [2]

(b) A battery has electromotive force (e.m.f.) 4.0 V and internal resistance $0.35\ \Omega$. The battery is connected to a uniform resistance wire XY and a fixed resistor of resistance R , as shown in Fig. 5.1.

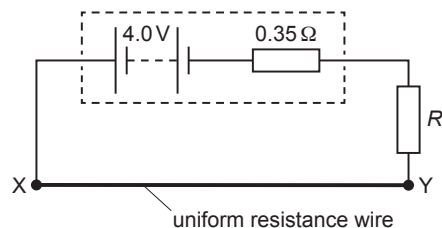


Fig. 5.1

Wire XY has resistance $0.90\ \Omega$. The potential difference across wire XY is 1.8 V .

Calculate:

(i) the current in wire XY

current = A [1]

(ii) the number of free electrons that pass a point in the battery in a time of 45 s

number = [2]

(iii) resistance R .

$R = \dots\dots\dots\ \Omega$ [2]

(c) A cell of e.m.f. 1.2 V is connected to the circuit in (b), as shown in Fig. 5.2.

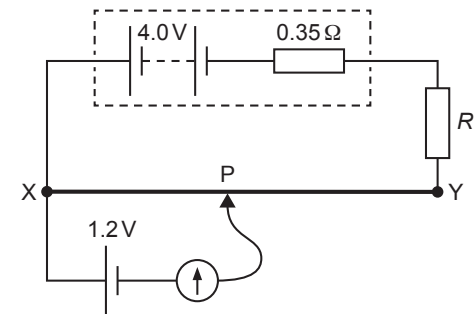


Fig. 5.2

The connection P is moved along the wire XY. The galvanometer reading is zero when distance XP is 0.30 m .

(i) Calculate the total length L of wire XY.

$L = \dots\dots\dots\text{ m}$ [2]

(ii) The fixed resistor is replaced by a different fixed resistor of resistance greater than R .

State and explain the change, if any, that must be made to the position of P on wire XY so that the galvanometer reading is zero.

.....

 [2]

[Total: 11]