

SCHOOL: Your school name

SENIOR FOUR PHYSICS · UNIT 5 QUIZ

Direct Current Circuits · FREE SAMPLE

MARKING SCHEME (TEACHER'S COPY)

Academic year: 20..... – 20.....

Date:/...../20.....

Duration: 1 hour 30 minutes

Total marks: 22

INSTRUCTIONS

1. A full unit quiz has three sections and 50 marks: A (10 marks), B (20 marks), C (20 marks).
2. This free sample is a short extract of each section.
3. Calculators may be used.

SECTION A: OBJECTIVE QUESTIONS

Answer ALL questions. Each question carries 1 mark.

1. Two identical lamps are connected to the same battery, first in series and then in parallel. Ignoring internal resistance, which statement is correct? (1 mark)

- A. Each lamp is brighter in parallel, because each gets the full battery voltage
- B. Each lamp is brighter in series, because the same current flows through both
- C. Brightness is unchanged, because the lamps and the battery are the same
- D. Each lamp is brighter in series, because the total resistance is then larger

Answer: A. Each lamp is brighter in parallel, because each gets the full battery voltage

Explanation: In series each lamp gets half the battery voltage; in parallel each gets the full voltage, so $P = V^2/R$ is four times larger for each lamp.

2. What is the main advantage of connecting several identical cells in parallel rather than using a single cell? (1 mark)

- A. It raises the total e.m.f. above that of one cell, so a larger current flows
- B. It raises the total internal resistance, so the cells last much longer
- C. It lowers the total internal resistance, so a larger current can be drawn
- D. It lowers the terminal voltage, so less power is wasted in the external circuit

Answer: C. It lowers the total internal resistance, so a larger current can be drawn

Explanation: Parallel identical cells keep the same overall e.m.f. as one cell but reduce the combined internal resistance, allowing a larger current to be supplied.

3. A car battery has an e.m.f. of 12.6 V. While the starter motor draws 150 A, the p.d. across the battery terminals falls to 9.6 V. What is the internal resistance of the battery? (1 mark)

- A. 0.064 Ω
- B. 0.084 Ω
- C. 0.020 Ω
- D. 50 Ω

Answer: C. $0.020\ \Omega$

Explanation: Lost volts = $12.6 - 9.6 = 3.0\text{ V} = Ir$, so $r = 3.0 \div 150 = 0.020\ \Omega$.

4. When a Wheatstone bridge is balanced, no current flows through its galvanometer.

(True / False)

(1 mark)

Answer: True

Explanation: At balance the two ends of the galvanometer are at the same potential, so there is no p.d. across it and the current is zero.

5. For resistors connected in _____, the same current flows through each resistor, but the voltage divides between them.

(1 mark)

Answer: series

Explanation: In a series connection there is only one current path, so current is common while voltage divides across each resistor.

6. The resistance that opposes current flow inside a battery or cell itself is called its _____ resistance.

(1 mark)

Answer: internal

Explanation: Internal resistance is the resistance within the source itself, causing a voltage drop when current flows.

SECTION B: SHORT ANSWER QUESTIONS

Answer ALL questions.

7. A single-loop circuit has a cell of e.m.f. 9 V , internal resistance $1\ \Omega$, connected to an external resistor of $2\ \Omega$. What current flows in the circuit?

(2 marks)

Answer: 3 A

Model answer: Total resistance = $r + R = 1 + 2 = 3\ \Omega$; $I = \varepsilon / R_{\text{total}} = 9/3 = 3\text{ A}$.

Marking: 1 mark for the correct answer · 1 mark for a correct reason or working.

8. What is the formula for the equivalent resistance of two resistors R_1 and R_2 connected in parallel?

(2 marks)

Answer: $1/R = 1/R_1 + 1/R_2$

Model answer: For resistors in parallel, the reciprocal of the equivalent resistance equals the sum of the reciprocals of each resistance.

Marking: 1 mark for the correct answer · 1 mark for a correct reason or working.

9. State whether this statement is true or false, and give a reason: "An ideal voltmeter has infinite resistance, so it takes no current from the circuit it is connected to."

(2 marks)

Answer: True

Model answer: With infinite resistance no current is diverted through the voltmeter, so connecting it does not change the p.d. it measures.

Marking: 1 mark for True/False · 1 mark for a correct reason.

SECTION C: STRUCTURED QUESTIONS

Answer ALL questions. Show your working.

10. Direct Current Circuits

(10 marks)

- (a) A source of e.m.f. 12 V supplies a current of 2 A to a circuit. What total power is delivered by the source? (3 marks)

Answer: 24 W

Model answer: Power delivered by the source, $P = \varepsilon I = 12 \times 2 = 24 \text{ W}$.

Marking: Formula or method: 2 marks · correct answer with unit: 1 mark.

- (b) In a metre bridge, an unknown resistor X is in the left gap and a 6.0Ω standard resistor is in the right gap. The balance point is 40.0 cm from the left end of the wire. What is X? (3 marks)

Answer: 4.0Ω

Model answer: $X/6.0 = l_1/l_2 = 40.0/60.0$, so $X = 6.0 \times 40.0 \div 60.0 = 4.0 \Omega$.

Marking: Formula or method: 2 marks · correct answer with unit: 1 mark.

- (c) Three resistors of 2Ω , 3Ω , and 5Ω are connected in series. What is the total resistance? (4 marks)

Answer: 10Ω

Model answer: In series: $R = 2 + 3 + 5 = 10 \Omega$.

Marking: Formula or method: 3 marks · correct answer with unit: 1 mark.

END