National 5 Physics
Electricity

Learning Outcomes

1. Electrical Charge Carriers

- ☐ Define electrical current as the electric charge transferred per unit time.
- ☐ Use an appropriate relationship to solve problems involving charge, current and time.

$$Q = It$$

- ☐ Know the difference between alternating and direct current.
- ☐ Identify a source (as a.c. or d.c.) based on oscilloscope trace or image from data logging software.

2. Potential Difference (Voltage)

- ☐ Know that a charged particle experiences a force in an electric field.
- ☐ Know the path a charged particle follows:
  - between two oppositely charged parallel plates;
  - near a single point charge;
  - between two oppositely charged points;
  - between two like charged points.
- ☐ Know that the potential difference (voltage) of the supply is a measure of the energy given to the charge carriers in a circuit.

3. Ohm's Law

- ☐ Calculate the gradient of the line of best fit on a V-I graph to determine resistance.
- ☐ Use appropriate relationships to solve problems involving potential difference (voltage), current and resistance.

$$V = IR \quad ; \quad V_2 = \left(\frac{R_2}{R_1 + R_2}\right) V_S \quad ; \quad \frac{V_1}{V_2} = \frac{R_1}{R_2}$$

- ☐ Know the qualitative relationship between the temperature and resistance of a conductor.
- ☐ Describe an experiment to verify Ohm's law.

4. Practical Electrical and Electronic Circuits

- ☐ Measure current, potential difference (voltage) and resistance, using appropriate meters in simple and complex circuits.
- ☐ Know the circuit symbol, function and application of standard electrical and electronic components: cell, battery, lamp, switch, resistor, voltmeter, ammeter, LED, motor, microphone, loudspeaker, photovoltaic cell, fuse, diode, capacitor, thermistor, LDR, relay, transistor.
- ☐ For transistors:
  - Know the symbols for an npn transistor and an n-channel enhancement mode MOSFET.
  - Explain their function as a switch in transistor switching circuits.
- ☐ Apply the rules for current and potential difference (voltage) in series and parallel circuits.

$$I_s = I_1 = I_2 = ... \quad ; \quad V_s = V_1 + V_2 + ...$$

$$I_p = I_1 + I_2 + ... \quad ; \quad V_p = V_1 = V_2 = ...$$

- ☐ Know the effect on the total resistance of a circuit of adding further resistance in series or in parallel.

- ☐ Use appropriate relationships to solve problems involving the total resistance of resistors in series and in parallel circuits, and in circuits with a combination of series and parallel resistors.

$$R_T = R_1 + R_2 + ... \quad ; \quad \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$$

5. Electrical Power

- ☐ Define electrical power in terms of electrical energy and time.
- ☐ Use an appropriate relationship to solve problems involving energy, power and time.

$$P = \frac{E}{t}$$

- ☐ Know the effect of potential difference (voltage) and resistance on the current in and power developed across components in a circuit.
- ☐ Use appropriate relationships to solve problems involving power, potential difference (voltage), current and resistance in electrical circuits.

$$P = IV \quad ; \quad P = I^2R \quad ; \quad P = \frac{V^2}{R}$$

- ☐ Select an appropriate fuse rating given the power rating of an electrical appliance.
  - A 3 A fuse should be selected for most appliances rated up to 720 W, a 13 A fuse for appliances rated over 720 W.