National 5 Physics

ELECTRICITY AND ENERGY

Study Guide

3.1 Conservation of Energy

At the end of the section you should be able to :

- ❑ 1 State that energy cannot be created or destroyed; it is changed from one form to another.
- ❑ 2 State that work done is a measure of the energy transferred.
- ❑ 3 Carry out calculations involving the relationship between work done, unbalanced force and distance.
- ❑ 4 Carry out calculations involving the relationship between change in gravitational potential energy, mass, gravitational field strength and change in height.
- ❑ 5 Carry out calculations involving the relationship between kinetic energy, mass and velocity.
- ❑ 6 Carry out calculations involving energy being transferred from one form to another.
- ❑ 7 State that systems are not 100% efficient and explain what has happened to the energy 'lost'.

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3.2 Charge Carriers and Electric Fields

At the end of the section you should be able to :

- ❑ 1 State that there are two types of electrical charge; positive and negative.
- ❑ 2 State that electrons are free to move in a conductor.
- ❑ 3 Describe electrical current in terms of the movement of charges around a circuit.
- ❑ 4 State that electrical current is defined as the electrical charge transferred per unit time.
- ❑ 5 Carry out calculations involving $Q = It$.
- ❑ 6 Explain in terms of current the terms d.c. and a.c.
- ❑ 7 State that the quoted value of an alternating voltage is less than its peak value.
- ❑ 8 State that a d.c. supply and an a.c. supply of the same quoted value will supply the same power to a given resistor.
- ❑ 9 State that the frequency of the mains supply is 50 Hz.
- ❑ 10 State that the mains supply voltage for the UK is 230V a.c.

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3.3 Potential Difference and Circuits

At the end of the section you should be able to :

- ❑ 1 State that, in an electric field, an electric charge experiences a force.
- ❑ 2 State that an electric field applied to a conductor causes the free electric charges In it to move.
- ❑ 3 State that the voltage of a supply is a measure of the energy given to the charges in a circuit.
- ❑ 4 Identify the circuit symbols and state the function of an ammeter, voltmeter, battery, resistor, variable resistor, fuse, switch, lamp, LED, photovoltaic cell, capacitor, diode, LDR, thermistor and relay.
- ❑ 5 Draw circuit diagrams to show the correct positions of an ammeter and voltmeter in a circuit.
- ❑ 6 State that in a series circuit the current is the same at all positions.
- ❑ 7 State that the sum of the potential differences across the components in series is equal to the voltage of the supply.
- ❑ 8 State that the sum of the currents in parallel branches is equal to the current drawn from the supply.
- ❑ 9 State that the potential difference across components in parallel is the same for each component
- ❑ 10 State that V/I for a resistor remains approximately constant for different currents.
- ❑ 11 State how the temperature affects the resistance of a substance.

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- ❑ 12 Carry out calculations involving the relationship $V = IR$.
- ❑ 13 Carry out calculations involving the relationships $R_T = R_1 + R_2 + R_3$ and $1/R_T = 1/R_1 + 1/R_2 + 1/R_3$.
- ❑ 14 State the benefits of using a ring circuit instead of an ordinary parallel circuit.
- ❑ 15 State that a potential divider circuit consists of a number of resistors, or a variable resistor, connected across a supply.
- ❑ 16 Carry out calculations involving potential differences and resistances in a potential divider.
- ❑ 17 Draw and identify the circuit symbol for an NPN transistor.
- ❑ 18 Draw and identify the circuit symbol for an n-channel enhancement MOSFET.
- ❑ 19 State that a transistor can be used as a switch.
- ❑ 20 Explain the operation of a simple transistor switching circuit.

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3.4 Electrical Energy and Power

At the end of the section you should be able to :

- ❑ 1 State that the electrical energy transformed each second = *VI.*
- ❑ 2 State the relationship between energy and power.
- ❑ 3 Carry out calculations using $P = VI$ and $E = Pt$.
- ❑ 4 Carry out calculations involving the relationships between power, current, voltage and resistance.
- ❑ 5 Know the approximate power rating of various electrical appliances.
- ❑ 6 Choose the correct fuse for an appliance if you are told its power rating.
- ❑ 7 Explain power loss in transmission lines.

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3.5 Heat

At the end of the section you should be able to :

- ❑ 1 State that the kinetic energy of a substance is a measure of the mean kinetic energy of the particles.
- ❑ 2 Explain the connection between temperature and heat energy.
- ❑ 3 State that the same mass of different materials needs different quantities of heat energy to change their temperature by one degree celsius.
- ❑ 4 Carry out calculations involving specific heat capacity.
- ❑ 5 State that heat is gained or lost by a substance when its state is changed.
- ❑ 6 State that a change of state does not involve a change in temperature.
- ❑ 7 Carry out calculations involving specific latent heat.

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3.6 Gas Laws

At the end of the section you should be able to :

- ❑ 1 State that pressure is the force per unit area exerted on a surface.
- ❑ 2 Carry out calculations involving pressure, force and area.
- ❑ 3 Describe how the kinetic model accounts for the pressure of a gas.
- ❑ 4 State that the pressure of a fixed mass of gas at constant temperature is inversely proportional to its volume.
- ❑ 5 State that the pressure of a fixed mass of gas at constant volume is directly proportional to its temperature measured in Kelvin.
- ❑ 6 State that the volume of a fixed mass of gas at constant pressure is directly proportional to its temperature measured in Kelvin.
- ❑ 7 Explain what is meant by absolute zero of temperature.
- ❑ 8 Carry out calculations to convert temperatures in ^{o}C to K and vice versa.
- ❑ 9 Carry out calculations involving pressure, volume and temperature of a fixed mass of gas using the general gas equation.
- ❑ 10 Explain the gas laws in terms of the kinetic model.