O LEVEL PHYSICS REVISION

PREFACE:

This book is prepared for Physics revision of the O level syllabus. The topics are presented in a short but accurate manner for a quick revision.

No pictures or diagrams are used in this book to reduce the size.

Readers should make it a point to refer back to their textbook for their reference.

It is hoped that the book achieves its aim of helping readers to grasp the key facts for their revision.

CONTENTS:

1. MEASUREMENTS
2. SPEED, VELOCITY & ACCELERATION
3. FORCES
4. MOMENTS - THE TURNING EFFECTS OF FORCES
5. WORK, ENERGY & POWER
6. THERMAL EXPANSION
7. MEASUREMENT OF TEMPEARATURE
8. MELTING, BOILING & EVAPORATION
9. HEAT TRANSFER
10. WAVES - BASIC WAVE PROPERTIES
11. LIGHT
12. SOUND
13. MAGNETISM
14. STATIC ELECTRICITY
15. ELECTRICITY
16. ELECTRICAL ENERGY
17. ELECTROMAGNETIC INDUCTION
18. RADIOACTIVITY

1. MEASUREMENTS

Key notes:

1. The S.I unit for length is metre (m); for mass is kilogram (kg) and for time is seconds (s).
2. When using a ruler, try to avoid parallex and end errors.
3. The ruler can be read up to 1 decimal place in cm, e.g. 4.3cm.
4. The jaws of the vernier callipers enable us to measure the interval or external diameter of an object accurately.
5. The vernier callipers can be read up to 2 decimal places in cm, e.g. 2.34cm. A ruler can be read up to only 1 decimal place in cm, e.g. 2.3cm.
6. When reading the vernier callipers, (e.g. 2.34cm) 2.3cm is read from the main scale. 0.04cm is read from the vernier scale.
7. A micrometer screw gauge may be used to measure lengths less than 4cm. For length of 1cm to 10cm, the vernier callipers may be used. To measure length greater than 10cm, a metre rule is suitable.
8. The mass of an object is the amount of matter it contains.
9. The mass of an object is constant.
10. The period of oscillation of a simple pendulum increases as its length increases, but is independent of the amplitude of the oscillation and the mass of its bob.
11. Units for density : kg/m^3 or g/cm^3
12. $1\ g/cm^3 = 1000\ kg/m^3$

Formulas:

- The Simple Pendulum

  Frequency, f = one second / period

  $= 1 / T$

- Density, ρ = mass / volume

2. SPEED, VELOCITY & ACCELERATION

Key notes:

1. A scalar quantity has only a magnitude while a vector quantity has both a magnitude and a direction.
2. Speed is distance moved per unit time. It is a scalar quantity.
3. Velocity is distance moved per unit time in a particular direction. It is a vector quantity.
4. Displacement is the distance moved from a fixed point in a particular direction.
5. In a displacement-time graph, gradient = velocity.
6. For a particle moving with a constant velocity away from the observer, the gradient is a positive constant.
7. For a particle moving with a constant velocity towards the observer, the gradient is a negative constant.
8. For a particle moving with an increasing velocity away from the observer, the gradient is increasing.
9. For a particle moving with a decreasing velocity and eventually coming to a stop, the gradient is decreasing and eventually becomes zero.
10. Acceleration, a = rate of change of velocity.
11. Without air resistance, all objects fall with the same acceleration when released from rest.
12. The velocity-time graph of an object released from rest and falling freely will show a constant increaseof velocity with time.
13. Due to air resistance, an object released from a height eventually reaches a constant velocity called the terminal velocity.

Formulas:

- Speed = distance moved / time taken

  $v = d / t$ (m/s or km/h)

- Average speed = total distance moved / total time taken

- Velocity = distance moved in a particular direction / time taken

- Acceleration = change of velocity / time taken for the change
  = (final velocity - initial velocity) / time taken for the change
  $a = (v - u) / t$ or $v = u + at$

  where a = final velocity
  u = initial velocity
  t = time taken
  a = acceleration

- In a velocity-time graph, gradient = acceleration, and area under the graph = distance travelled.
  (1/2) x time (s) x velocity (m/s)

- FREE FALL & ACCELERATION DUE TO GRAVITY
  $a = v - u / t$

  a - acceleration
  v - velocity
  u - released from rest (u = 0)
  t - time

3. FORCES

Key notes:

1. A force may produce a change in the shape and size of an object.
2. Below the limit of proportionality, the extension of a spring is directly proportional to the force applied on it.
3. The unit for force is the newton (N).
4. In changing the motion of an object, a force can cause it to start moving, to accelerate or decelerate, to change its direction of motion.

5. NEWTON'S LAWS OF MOTION:

a) Newton's first law of motion states that an object a rest will remain at rest

b) An object moving with a uniform velocity will continue to do so UNLESS a resultant or net force acts on it.

6. Inertia is the tendency for a body to resist any change to its motion (i.e. whether it is stationary or moving with a uniform velocity.)
7. The greater the mass, the larger the inertia.
8. Newton's second law states that: The acceleration of an object is directly proportional to the force applied on it.
9. Friction is a force that opposes motion. Its direction is always opposite to the direction of motion.
10. Friction depends on the nature of the surfaces in contact, the force pressing the two surfaces together.
11. Friction does not depend on the surface area in contact.
12. Friction can be an advantage or a disadvantage.
13. The mass of an object is the amount of matter it contains. It is always constant and does not change when gravity changes.
14. The weight of an object is the force due to gravity acting on the object.
15. The weight of an object is not constant but depends on the gravitational attraction.

Formulas:

- Hooke's law: $F \propto e$

$F = ke$

F - force

k - F / e (spring constant)

e - extension

- Newton's Second Law of Motion,

  $F = ma$

  force = mass x acceleration

- weight = mass x acceleration due to gravity

  $W = mg$ - measured in newtons (N)

4. MOMENTS - THE TURNING EFFECTS OF FORCES

Key notes

1. The moment of a force means the turning effect of a force.
2. The principle of moments states that for an object in equilibrium, the sum of all clockwise moments = the sum of all anticlockwise moments.
3. Levers use the principle of moments.
4. If the distance of the effort from the fulcrum is greater than the distance of the load from the fulcrum, then a small effort can be used to lift a heavy load.
5. The centre of gravity of an object is the point where its whole weight seems to act.
6. When an object is hung freely, its centre of gravity is located vertically below the point of support.
7. An object is in a stable equilibrium if its centre of gravity is raised when tilted and it returns to its initial position when released.
8. An object is in unstable equilibrium if its centre of gravity is lowered when the object is tilted and it topples over to a new position when released.
9. An object is in a neutral equilibrium if its centre of gravity is not raised or lowered when displaced.
10. The stability of an object increase if its centre of gravity is lower or its base area is increased

Formulas:

- Moment = F x d

  = force x perpendicular distance from the pivot to the force

  Units is Nm (newton metre)

5. WORK, ENERGY & POWER

Key notes:

1. Energy is the capacity to do work. It is measured in joules.
2. The principle of conservation of energy states that energy can neither be created nor destroyed but it can be changed from one form to another.
3. In a falling object, the potential energy is converted into kinetic energy.
4. When friction is not negligible, work has to be done against it.
5. The main sources of energy are: fossil fuels, hydroelectric schemes, solar energy, geothermal energy and wind energy.
6. Power is rate of doing work.
7. The unit for power is the watt (W).

Formulas:

- Work done = force x distance moved in the direction of the force

  = $F \times d$

  = J (joule)

- Kinetic Energy (K.E)

  K.E. = $1/2\ mv^2$

  m - mass

  v - speed

- Gravitational Potential Energy (P.E)

  P.E = mgh

  m - mass

  g - acceleration due to gravity

  h - height

- The energy released during a nuclear reaction is given by $E = mc^2$.

- Efficiency = (useful energy output/ energy input) x 100%

- POWER

  $P = E / t$

  Power = work done / time taken

  = energy output / time taken

  Unit is the watt (W).

6. THERMAL EXPANSION

Key notes:

1. Solids expand when heated and contract when cooled.
2. Different solids of the same volume expand by different amounts when heated through the same increase of temperature.
3. A large force is set up when a solid is expanding or when a solid is contracting.
4. Applications of thermal expansion include thermostats, fire alarms, bimetallic thermometers, fixing rivets and fitting axles to flywheels.
5. To avoid damage to concrete roads, metal bridges, telephone cables and steam pipes due to temperature changes, allowance must be made for expansion and contraction to occur.
6. When the same volume of a liquid and a solid are heated through the same increase in temperature, the liquid expands more than the solid.
7. Different liquids of the same volume expand by different amounts when heated through the same increase in temperature.
8. Water contracts when its temperature increase from 0 °C to 4 °C.
9. The density of water is greatest at 4 °C.
10. Ice floats on water with 10% of its volume above the water surface.
11. Gases expand much more than solids or liquids when heated.
12. The density of a gas decrease when it is heated.

7. MEASUREMENT OF TEMPERATURE

Key notes

1. Temperature is the measure of hotness or coldness of a body.
2. A thermometer makes uses of a physical property that changes with temperature.
3. On the centigrade scale, the lower fixed point is the temperature of pure melting ice (0 °C) and the upper fixed point is the temperature of steam above boiling water at standard atmospheric pressure (100 °C).
4. On the absolute scale, temperature is measured in kelvins (K).
5. Absolute zero temperature is 0 K (-273 °C). This is theoretically the lowest possible temperature.

6. The advantages of using mercury for liquid-in-glass thermometers are:

a) It does not stick to glass
b) It conducts heat well
c) It is easily visible
d) It expands uniformly
e) It has a wide range, from -40 °C to 355 °C

7. The range of a clinical thermometer is from 35 °C to 42 °C.
8. In a clinical thermometer, the construction prevents mercury thread from flowing back into the bulb when the thermometer is removed from the patient’s mouth.
9. A thermocouple thermometer is suitable for measuring high temperatures and those that vary rapidly.

Formulas:

- θ °C = (273 + θ) K

8. MELTING, BOILING & EVAPORATION

Key notes:

1. Matter is made up of particles in a constant state of random motion.
2. At higher temperatures, particles in a solid vibrate more vigorously.
3. Inter-particles distance is greatest in gases and smallest in solids.
4. Melting occurs when a substance changes from the solid state to the liquid state at a constant temperature, called its melting point.
5. During melting, the temperature remains constant even though heat energy is continuously being supplied because this energy is used to bring about a change in state.
6. When allowed to cool sufficiently, the substance will change from the liquid state to the solid state. The constant temperature at which solidification occurs is called the freezing point.
7. The melting point and freezing point of a substance are the same temperature.
8. Different substance have different melting points.
9. In a cooling curve, the freezing point or melting point of a substance is indicated by the part of the curve which shows a constant temperature.
10. During freezing/melting, the substance exists in both the solid and liquid states.
11. When heated, a liquid changes to the gaseous state at a fixed constant temperature called its boiling point.
12. During boiling, the temperature remains constant because the heat energy provided is used by the particles to escape from the liquid surface , i.e to bring about a change of state.
13. Condensation occurs when a vapour is sufficiently cooled and changes to the liquid state. Energy of the particles is given up to the surroundings.
14. The boiling point and condensation point of a substance are the same temperature.
15. Evaporation causes cooling.
16. The rate of evaporation is affected by temperature, humidity, surface area and the presence of wind.

17. Factors that raise the boiling point of a liquid are:

a) An increase in pressure

b) The presence of impurities

18. Factors that lower the melting point of ice are:

a) An increase in pressure,

b) The presence of impurities.

9. HEAT TRANSFER

Key notes:

1. In poor conductors, heat is transferred solely by the vibrations of particles.
2. In metals, more energetic free electrons from the hot end moving to the cold end help to transfer heat energy faster from one end to the other.
3. Conduction is the transfer of heat through a material medium by the vibrations of the particles in the medium.
4. Metals are good conductors of heat.
5. Non-metals, liquids and gases are poor conductors of heat.
6. Convection is the main mode of heat transfer in fluids.
7. Convection occurs when the warmer part of the fluid moves up while the cooler part sinks down. The warmer part of the fluid has a lower density than the cooler part.
8. Streams of warm moving fluids are called convection currents.
9. Heat is circulated around the fluid by convection current until the temperature throughout the fluid has become the same.
10. Radiation is a process of heat transfer that does not require a material medium. Heat is transmitted in the form of electromagnetic waves.
11. A dull black surface is both a good emitter and a good absorber of radiant energy.
12. A shiny polished surface is both a poor emitter and a poor absorber of radiant energy.

10. WAVES - BASIC WAVE PROPERTIES

Key notes:

1. Waves are means of energy transfer.
2. Frequency is the number of waves generated per second. Unit - hertz (Hz) which is also in cycles/second.

3. Wavelength is the distance

a) Between consecutive troughs.

b) Between consecutive crests.

c) Between two consecutive similar points on a wave. Unit - metre (m).

4. Wave velocity is the distance travelled by a crest in one second. Unit - m/s.
5. Amplitude is the maximum displacement of a particle from its equilibrium position. Unit - metre (m).
6. Periodic time T is the time for one complete wave to pass through a certain point.
7. In a transverse wave, the vibrations of the particles are perpendicular to the direction of wave travel.
8. Examples of transverse waves are light waves and water waves.
9. In a longitudinal wave, the vibrations of the particles are parallel to the direction of wave travel.
10. An example of longitudinal waves is sound waves.
11. The particles in a medium vibrate at the same frequency as the waves passing through it.
12. Examples of transverse waves are light waves and water waves.
13. In a longitudinal wave, the vibrations of the particles are parallel to the direction of wave travel.
14. An example of longitudinal waves is sound waves.
15. The particles in a medium vibrate at the same frequency as the waves passing through it.
16. Waves are reflected such that the angle of incidence is equal to the angle of reflection.
17. Refraction of waves is the change in the direction of travel due to a change in speed.
18. Water waves move faster in deep water. Their speed and wavelength decrease

in shallow water.

19. Water waves are refracted to become more parallel to the deep-shallow boundary when moving from a deeper region into a shallower region.
20. Electromagnetic waves are a family of transverse waves that travel at the speed of light, 3 x 10^8 m/s.
21. They can pass through a vacuum.
22. The only visible component of electromagnetic waves is visible light.
23. Gamma-rays have the shortest wavelengths while radio waves have the longest wavelengths.

Formulas:

- Periodic Time (T)

  $T = 1 / f$ seconds / cycle

  T - periodic time

  f - frequency

- Velocity (v)

  velocity = frequency x wavelength

  $v = f\lambda$

11. LIGHT

Key notes:

1. The laws of reflection:

a) The incident ray, the normal and the reflected ray all lie on the same plane,

b) The angle of incidence = the angle of reflection.

2. The image formed by a plane mirror:

a) is virtual,

b) is upright,

c) is laterally inverted,

d) has the same size as the object,

e) is located at the same distance behind the mirror as the object is in front of it.

3. Refraction is the bending of a ray of light as it moves from one medium into another. This is due to a change in the speed of light.
4. Light is refracted towards the normal when it travels from an optically less dense medium into an optically denser medium.
5. A thin converging lens converges rays parallel to the principal axis to a point on the principal axis called the principal focus.
6. The focal length is the distance between the principal focus and the optical centre of the lens.
7. Rays that pass through the optical centre of the lens are not deviated.
8. The action of a converging lens is based mainly on refraction.
9. The nature of the image formed by a convex lens is different depending on the object distance, u.

Formulas:

- LAWS OF REFRACTION

  Refractive index, $n = \sin i / \sin r$

  Refractive index = speed of light in vacuum / speed of light in medium

- REAL & APPARENT DEPTH

  Refractive index, n = real depth / apparent depth

  $= H / h$

12. SOUND

Key notes:

1. Sound is produce by vibrations.
2. Sound waves are longitudinal waves.
3. Sound waves consists of a series of compressions and rarefactions that move through the medium.
4. One wavelength of the sound wave is the distance between two consecutive compressions or rarefactions.
5. The range of audible frequencies for man is from 20 Hz to 20kHz.
6. Sound waves need a material medium for transmission.
7. Sound travels faster in liquids than in gases and fastest in solids.
8. Sound obeys the laws of reflection.
9. Echoes are caused by the reflection of sound.
10. The loudness of a sound increase if the amplitude of the sound wave increases.
11. The pitch of a sound increases if its frequency increases.
12. The same musical note from different musical instruments has different qualities.

Formulas:

- SOUND WAVES

  Speed = frequency x wavelength

  $v = f\lambda$

- SPEED OF SOUND

  The speed of sound = distance traveled / average time taken

  $= d / t$

- Uses of Echoes

  $d = vt / 2$

  d - depth of sea

  v - speed of sound

  t - time between transmission & reception of sound

13. MAGNETISM

Key notes:

1. The poles of a magnet are the parts of a magnet where the magnetic force is strongest.
2. The pole of the magnet that points north is known as the N-pole, while the other pole of the magnet is the S-pole.
3. Like poles repels, unlike poles attract.
4. The repulsion between like poles is used to determine the polarity of a magnet.
5. Induced magnetism is the magnetism acquired by an unmagnetised magnetic material when it is close to or in contact with a permanent magnet.
6. A steel bar is magnetized by placing it inside a solenoid carrying a direct current.
7. The poles of the magnet produced can be determined using the right-hand grip rule.

8. A magnet becomes weaker if:

a) It is stored without its soft-iron keepers.

b) It is dropped or heated.

9. A magnet is demagnetized by placing it inside a solenoid carrying an alternating current and then withdrawing it far away from the solenoid.
10. A magnetic field is the region in space where a magnetic force is exerted.
11. The magnetic field pattern around a magnet can be plotted using a plotting compass or iron fillings.
12. The magnetic lines of force point away from a N-pole and towards a S-pole.
13. At a neutral point, the resultant magnetic force is zero.
14. Soft iron is easily magnetized strongly but the induced magnetism is only temporary.
15. Steel is more difficult to demagnetize but the induced magnetism is permanent.
16. Electromagnets are made by winding a coil of insulated copper wire around a soft iron core.
17. An electromagnet loses its magnetism when the current is switched off.

14. STATIC ELECTRICITY

Key notes:

1. There are two types of electric charges, i.e. positive and negative charges.
2. Charge is measured in coulombs (C).
3. Like charges repel; unlike charges attract.
4. When an object loses or gains electrons, its becomes charged.
5. An object becomes negatively charged if it gains electrons. It becomes positively charged if it loses electrons.
6. Electrical conductors allow charges (electrons) to flow easily while electrical insulators do not.
7. When a positively charged object is earthed, electrons flow from the earth to the object.
8. When a negatively charged object is earthed, electrons flow from the earth to the object.
9. When a negatively charged object is earthed, electrons flow from the object to the earth.
10. Water and human body can conduct charges but they are poor conductors.
11. In electrostatic induction, the charge induced close to the inducing charge is equal and opposite.
12. To charge a body positively by induction, a negatively charged body is needed.
13. An uncharged gold leaf electroscope can only determine whether an object is charged or not. It cannot determine the type of charge on the object.
14. A charged electroscope is used to identify the type of charge in an object, and to determine whether a material is an insulator or conductor of an electric charge.
15. Charges building up on an insulated object may cause sparks to occur.
16. To prevent sparks occurring, an insulated object must be connected to the earth by a conductor.

15. ELECTRICITY

Key notes:

1. Current is the rate of flow of charges
2. Current is measured by an ammeter in amperes (A).
3. Current only flows between two points in a circuit if there is a potential difference between the two points.
4. A voltmeter is use to measure the potential difference.
5. Unit for potential difference is the volt (V).
6. The electromotive force (e.m.f.) of a cell is the energy dissipated by the cell in driving each coulomb of charge around the complete circuit.
7. The unit for e.m.f. is also the volt (V).
8. Electrical resistance is the resistance to current flow. It is measured in ohms,Ω.
9. A rheostat has a variable resistance.
10. For most metallic conductors, resistance increase with temperature.
11. For thermistors, resistor decreases with temperature.
12. At a junction in a circuit, the sum of the currents entering the junction is equal to the sum of the currents leaving it. $I1 + I2 = I3 + I4$

13. In a series circuit,

a) the current flowing through at every point is the same.
b) the combined resistance is the sum of the individual resistances.
c) the potential difference across the whole circuit is the sum of the potential difference across each component.

14. In a parallel circuit,

a) the current from the voltage source is the sum of the currents in the separate branches.
b) the potential difference across the effective resistance is the same as the potential difference across each component.

Formulas:

- Direction of Convectional Current & Electron Flow

$I = Q / t$

ampere = coulomb / second

= coulomb per second

- Electromotive Force, Volts

  Volt = J/C

  joule / coulomb

- Resistance of a Wire

  Resistance, $R \propto 1 / A$

  $R = \rho l / A$

  l - length

  A - cross sectional area

  ρ - constant which depends on the material of the wire.

- OHM'S LAW

  $I \propto V$

  $V/I = R$

  or $V = IR$

- Series Circuits

  Total resistance, $R = R1 + R2 + R3$

  $I = V/(R1 + R2 + R3)$

  $V = V1 + V2 + V3$

- Parallel Circuits

  $I = I1 + I2 + I3$

  $1/R = (1/R1) + (1/R2) + (1/R3)$

  $V = V1 = V2 = V3$

16. ELECTRICAL ENERGY

Key notes:

1. In a household circuit, the three wire are the live wire, the netral wire and the earth wire.
2. Fuses and switches are placed in the live wire.
3. The earth wire is connected to the metal casing of the appliance.
4. A fuse is suitable for use if its current rating is slightly higher than the normal operating current.
5. For an appliance which has double insulation, the inside metal wall is covered with an insulating sheet so that if a live wire becomes loose and touches the inside wall, current will not leak out of the wall.
6. Appliances are wired to three-pin plugs which are in turn plugged into wall sockets.
7. In a three-pin plug, a fuse is connected to the live wire.
8. Electricity is use in lighting, heating and motors.
9. When current flows through the filament of a bulb, heat and light are dissipated.
10. A greater percentage of electrical energy is converted into light in a fluorescent lamp when compared to a filament lamp.
11. Heating elements of heaters are made of Nichrome wire.
12. Motors are used to convert electrical energy into mechanical energy.

13. The main source of dangers of electricity are

a) damp conditions
b) overheating of cables
c) Damaged insulation

Formulas:

- Power dissipated, $P = IV$

  $P = I^2R$

  $P = V^2 / R$

- Electrical energy = IVt

$= I^2Rt$

$= (V^2/R)$

- THE COST OF ELECTRICAL ENERGY

  1 kWh = 1 kilowatt x 1 hour

  = 1000watt x 1 hour

  = (1000 J/s) for 1 hour

  = (1000 J/s) x (60 x 60s)

  = 3.60 x 10(*6)J **power of 6*

- Cost of electricity consumption = (total kWh) x (cost per kWh)

17. ELECTROMAGNETIC INDUCTION

Key notes:

1. Faraday's law of electromagnetic induction: When the magnetic field linked with a circuit changes, an e.m.f. is induced. The induced e.m.f. is directly proportional to the rate of change of magnetic flux.
2. Lenz's law: The direction of the induced current is such as to oppose the change that produces it.
3. An a.c. generator uses the principle of electromagnetic induction.
4. A simple a.c. generator consists of a coil of wire attached to a pair of slip rings rotating between the poles of a magnet.
5. The slip rings enable the same end of the coil to be in contact with the same carbon brush.
6. The induced e.m.f. in an a.c. generator is alternating between the maximum positive value and the minimum negative value continuously.
7. The working principle of a transformer: when an A.C. flows in the primary coil, the magnetic field changes. This change in magnetic field produces an induced e.m.f. in the secondary coil.
8. If the transformer is 100% efficient, output power = input power.
9. In electric power transmission, transformers are use to step-up the voltage so that the current in the transmission cables is small; hence reducing the power loss in the cables.
10. A.C. rather than D.C. is use for electricity transmission down using transformers. Transformers do not work on D.C.

Formulas:

- TRANSFORMERS

  Voltage of secondary coil, $V(s)$ / Voltage of primary coil, $V(p)$ =

  No. of turns in secondary coil, $N(s)$ / No. of turns in primary coil, $N(p)$

  $= [V(s) / V(p)] = [N(s) / N(P)]$

- If the transformer is 100% efficient,

  output power = input power

  $I(s)V(s) = I(p)V(p)$

18. RADIOACTIVITY

Key notes:

1. Alpha-particles are helium nuclei, have strong ionizing power, are stop by a piece of paper and are deflected by a magnetic or electric field.
2. Beta-particles are fast moving electrons, have weak ionizing power, are stop by a few mm of aluminium and are deflected easily by a magnetic or electric field.
3. Gamma-rays are high energy electromagnetic waves. Though their ionizing power is very weak, they have high penetrating power.
4. A charged electroscope is an effective detector of α-particles.
5. A G-M tube connected to a ratemeter can read the count rate or rate of radioactivity of a radioactive source.
6. In the cloud chamber, the various types of radiation can be identified from their tracks.
7. In the absence of a radioactive source, a background count rate is obtained due to the background radiations.
8. In the nuclear model of the atom, an atom consists of a nucleus, which made up of protons and neutrons, with the electrons orbiting in the space around the nucleus. The number of electrons equals the number of protons.
9. The proton number Z is the number of protons in a nucleus.
10. The nuclide is a nuclear species with a specific combination of protons and neutrons.
11. Isotopes have the same proton number but different nucleon numbers.
12. During α-decay, the proton number decreases by two, and the nucleon number decrease by four.
13. During ß-decay, the proton number increase by one, and the nucleon number remains unchanged.
14. For γ-emission, there is no change in the proton number or the nucleon number.
15. Radioactive decay is a spontaneous random process which is unaffected by chemical conditions, temperature or other physical conditions.
16. The half-life of a radioactive element is the time taken for half the number of atoms in a sample to decay.
17. The rate of decay or radioactivity of a radioactive sample is directly proportional to the number of radioactive atoms present.
18. Radioisotopes are widely use in medicine, industries and agriculture.

19. Exposure to nuclear radiation is harmful to health.
20. Precautions need to be taken in the storage, use and disposal of radioactive materials.
21. Energy released in a nuclear reaction is due to the decrease in mass in the reaction.
22. Nuclear fission is the splitting of a nucleus into smaller nuclei.
23. During fission of an U-235 nucleus, two or three secondary neutrons are produced.
24. Nuclear fusion is the union of two small nuclei to form a larger nucleus.