

SOLUTIONS PHYSICS IGCSE P2 V1

Objective Section

Q no:	Correct Answer	Explanation (if any)
1	D. Only weight is a force.	Mass is a measure of the amount of matter in an object, while weight is the force exerted by gravity on that mass.
2	B.	The graph should show a straight line (constant speed) followed by a curve (constant acceleration).
3	A. 0°C	The temperature of the remaining ice stays at 0°C until all the ice has melted.
4	C. 200g	The extension of the spring is directly proportional to the mass hung on it.
5	C.	During evaporation, molecules escape from the surface, and the temperature of the liquid decreases as the higher-energy molecules leave.
6	D.	Strain energy is the energy stored in an object due to deformation, such as the compression of springs.
7	B. Nuclear fission	Nuclear fission is used to generate electricity by boiling water to produce steam.
8	D. The image is inverted.	A converging lens produces an inverted image on the screen.
9	B. Both at the top of the box.	Cold air sinks, so placing ice packs at the top keeps the entire box cool.
10	C. Reflection	Echoes are caused by the reflection of sound waves.
11	C. 2kHz	Human hearing typically ranges from 20Hz to 20kHz.
12	D. The speed of violet light decreases more than that of red light.	Different colors of light travel at different speeds in glass, causing dispersion.
13	B. Distance Y is the wavelength of the waves.	Wavelength is the distance between successive crests of a wave.
14	B. 9.0V	Using Ohm's law, $V = IR$, where $I = 0.50A$ and $R = 18\Omega$.
15	D.	In a time delay circuit, a capacitor stores energy and releases it over time to create the delay.
16	A. Putting it near a compass needle.	A compass needle will align with the magnetic field, indicating the north pole.
17	B. The rod and the balloon carry like charges.	Like charges repel each other.
18	C.	For a simple alternating current (a.c.) generator, the output voltage varies sinusoidally with time, oscillating above and below the zero voltage line. This is because the generator produces an alternating voltage that changes direction periodically.
19	D.	In a step-down transformer, the primary coil is the one connected to the input voltage, which is typically the coil with more turns.
20	B. Only a circuit breaker or a fuse.	These components protect the circuit from overheating.
21	C.	The diagram showing 3 protons, 4 neutrons, and 3 electrons.
22	C. 100mg	After 10 days (two half-lives), the mass reduces to one-quarter of the original.
23	B.	α -particles have a greater ionizing effect but less penetrating ability compared to β -particles.
24	B. X: negative cathode, Y: positive anode.	In a cathode-ray tube (CRT), the cathode is the negative electrode that emits electrons, and the anode is the positive electrode that attracts the electrons.
25	A. 0.9 g/cm ³	Density = mass/volume. Given the side of the cube is 2.0cm, volume = $2.0^3 = 8.0\text{cm}^3$. as $m = 7.2\text{g}$ Density = $7.2/8 = 0.9\text{g/cm}^3$

THEORETICAL PART:

Q. No. 1:

i) **1. Medical uses:** Radioactive isotopes are used in diagnostic imaging and cancer treatment.

2. Industrial applications: Radioactivity is used for measuring material thickness and inspecting welds.

ii) **1. Alpha-particle:** A particle consisting of two protons and two neutrons, emitted during radioactive decay.

2. Alpha decay: A type of radioactive decay in which an unstable atomic nucleus emits an alpha particle, reducing its atomic number and mass number.

iii) **Dalton's Atomic Theory:** Atoms are indivisible and identical for each element; they combine in simple ratios to form compounds, and in chemical reactions, atoms are rearranged but not changed into different elements.

iv) **1. Electricity Generation:** Electromagnetic induction is used in generators to produce electricity.

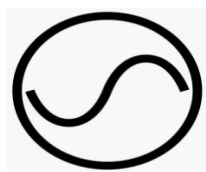
2. Voltage Transformation: Transformers use electromagnetic induction to change the voltage of alternating current.

3. Induction Heating: Induction cooktops use electromagnetic induction to heat cooking vessels directly.

v) The magnetic force on a current-carrying conductor is perpendicular to both the current direction and the magnetic field, following the right-hand rule.

Q. No. 2:

i)



ii) **Insulators** are materials that resist the flow of electric current. They have high electrical resistance and do not allow electrons to move freely. Examples of insulators include:

- **Rubber:** Rubber is commonly used to insulate electrical wires and cables due to its high resistance to electricity.
- **Glass:** Glass is an excellent insulator and is used in the construction of insulators for high-voltage power lines.
- **Plastic:** Many types of plastic, such as PVC (polyvinyl chloride), are used as insulating materials in electrical devices and wiring.

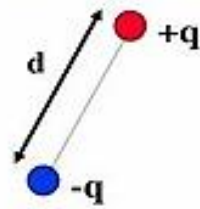
iii) **Electric dipoles** are pairs of equal and opposite electric charges separated by a small distance. This separation of charges creates a dipole moment, which is a vector pointing from the negative charge toward the positive charge.

The formula for the electric dipole moment (p) is given by:

$$P = q \cdot d$$

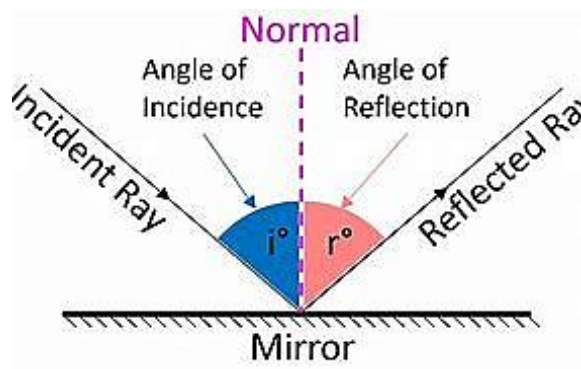
where p is the electric dipole moment, q is the magnitude of each charge, and d is the distance between the charges.

The Electric Dipole



An electric dipole consists of two equal and opposite charges (q and $-q$) separated a distance d .

iv)



v)

$$c = \frac{Q}{m\Delta T}$$

Plugging in the values, we get:

$$c = \frac{420.5 \text{ J}}{55 \text{ g} \times 15^\circ \text{C}}$$

$$c = \frac{420.5 \text{ J}}{825 \text{ g}^\circ \text{C}}$$

$$c = 0.509 \text{ J/g}^\circ \text{C}$$

Q. No. 3:

i)

Aspect	Boiling	Evaporation
Definition	Rapid vaporization at boiling point	Slow vaporization below boiling point
Temperature	Occurs at specific boiling point	Occurs at any temperature below boiling point
Speed	Rapid	Slow
Location	Throughout the liquid, including within	Only at the surface of the liquid

ii) When a body falls freely under gravity, the work done by gravity is **positive**.

This is because the force due to gravity (the weight of the body) acts in the same direction as the displacement of the body. Work done (WWW) is calculated as:

$$W = F \cdot d \cdot \cos \theta$$

Here:

- F is the force (gravity),
- d is the displacement,
- θ theta is the angle between the force and the displacement.

For a freely falling object, the angle $\theta=0^\circ$ and $\cos 0^\circ = 1$ Hence, the work done by gravity is positive, as the force contributes to the displacement.

iii) Gravitational Potential Energy, Elastic Potential Energy, Chemical Potential Energy, Electrical Potential Energy and Nuclear Potential Energy

iv) The quantity that is a measure of the turning effect of a force is torque. Torque is defined as the product of the force applied and the perpendicular distance from the axis of rotation to the line of action of the force. It is also sometimes referred to as the moment of force. Torque is a vector quantity and is measured in Newton-meters (Nm) in the SI system.

v) When an ultrasound wave reaches the kidney, it can be reflected, refracted, absorbed, or scattered. Part of an ultrasound wave is reflected back to the transducer, creating an image of the kidney's internal structure. Some of the wave continues deeper into the kidney, where it may be absorbed or scattered by different tissues. The reflected waves help in visualizing the kidney's internal structure and diagnosing any abnormalities.

Q. No. 4:

i) $E=V \times Q$

E is the energy transferred (in joules),

V is the potential difference of the battery (1.2 V), and

Q is the charge that flows (180 C).

Plugging in the values, we get:

$$E = 1.2V \times 180C$$

$$E = 216\text{joules}$$

ii) Scalars: Scalars are quantities that have only magnitude, or size. Speed is an example of a scalar quantity because it describes how fast an object is moving without specifying the direction. Scalar quantities can be added, subtracted, multiplied, and divided just like ordinary numbers.

Vectors: Vectors are quantities that have both magnitude and direction. Velocity is an example of a vector quantity because it not only describes how fast an object is moving (magnitude) but also in which direction. Vectors can be represented graphically as arrows, where the length of the arrow represents the magnitude and the direction of the arrow represents the direction.

PRACTICAL PORTION:

Q. No. 1:

- i) The output from the microphone displayed on the oscilloscope appears to be a periodic waveform, which suggests that the sound picked up by the microphone is likely a steady, continuous tone. The waveform has a regular pattern of peaks and troughs, indicating a consistent frequency and amplitude over time.
- ii) To determine the peak voltage of the output, we need to look at the highest point of the waveform above the baseline (0 voltage level). The vertical scale is marked in volts, so by counting the number of divisions from the baseline to the peak, we can calculate the peak voltage.
- iii) To check that the voltage calibration on the screen is correct, you could use a known reference voltage source to input a precise voltage to the oscilloscope. Then, you would compare the display on the oscilloscope with the known voltage. If the oscilloscope displays the reference voltage accurately within its specified accuracy range, the calibration can be considered correct. Additionally, you could use a multimeter to measure the voltage directly and compare it with the oscilloscope reading. Calibration should be done according to the manufacturer's instructions and using proper calibration equipment.

Q. No. 2:

- a) Evaporation occurs when water molecules near the surface gain enough kinetic energy to break free from the liquid phase and enter the gas phase. This process is driven by the random movement of water molecules, which occasionally acquire enough energy from their surroundings to overcome the attractive forces holding them in the liquid phase. As these molecules escape, they take away heat energy from the remaining water, cooling it down.
- b) Two differences between evaporation and boiling are:
1. Temperature: Evaporation can occur at any temperature, whereas boiling specifically refers to the rapid vaporization that occurs when a liquid reaches its boiling point temperature.
 2. Rate: Evaporation is a slower process that occurs at the surface of a liquid while boiling is a rapid process that occurs throughout the entire liquid when it reaches its boiling point.

c)

$$\text{Latent heat} = \frac{\text{Energy supplied}}{\text{Mass evaporated}}$$

First, we need to calculate the energy supplied by the heater:

$$\text{Energy supplied} = \text{Power} \times \text{Time}$$

$$\text{Energy supplied} = 60 \text{ W} \times 120 \text{ s}$$

$$\text{Energy supplied} = 7200 \text{ J}$$

Next, we calculate the mass of water evaporated:

$$\text{Mass evaporated} = 3.2 \text{ g}$$

Now, we can calculate the specific latent heat of vaporization:

$$\text{Latent heat} = \frac{7200 \text{ J}}{0.0032 \text{ kg}}$$

$$\text{Latent heat} = \frac{7200 \text{ J}}{0.0032 \text{ kg}}$$

$$\text{Latent heat} = 2,250,000 \text{ J/kg}$$

Q. No. 3:

a) Three characteristics of the image of the book formed by a plane mirror are:

1. Virtual: The image is virtual, meaning it is formed behind the mirror and cannot be projected onto a screen.
2. Upright: The image is upright, maintaining the same orientation as the object.
3. Equal in size: The image is the same size as the object.

b) i) Two uses of ultraviolet radiation are:

1. Sterilization: Ultraviolet radiation is used to sterilize surfaces, air, and water. It can effectively kill bacteria, viruses, and other microorganisms.
2. Forensic investigations: Ultraviolet light is used in forensic investigations to detect bodily fluids, such as blood or semen, which may not be visible under normal light.

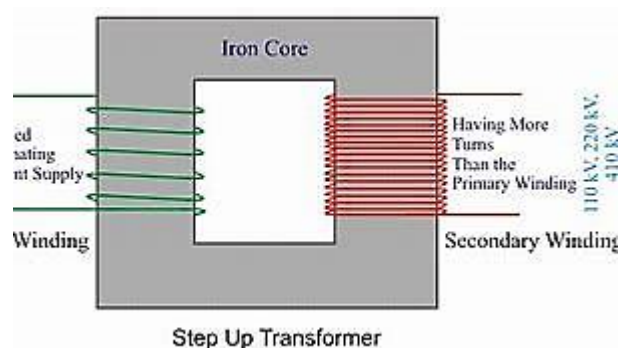
ii) Two possible harmful effects of excessive exposure to ultraviolet (UV) radiation are:

1. Skin damage: UV radiation can cause sunburn, premature ageing of the skin, and an increased risk of skin cancer. Prolonged or intense exposure to UV radiation can damage the skin's DNA, leading to mutations that can result in skin cancer.
2. Eye damage: UV radiation can also cause damage to the eyes, including cataracts, macular degeneration, and other eye conditions. The eyes are particularly sensitive to UV radiation, and prolonged exposure without protection can increase the risk of these conditions.

Q. No. 4:

a) The pointer in sensitive ammeter G deflects because when switch S is closed, a current is induced in coil P due to the changing magnetic field produced by coil Q. This induced current creates a magnetic field around coil P, which interacts with the magnetic field produced by coil Q. This interaction causes a force to be exerted on the coils, leading to the deflection of the pointer in ammeter G.

b) A step-up transformer consists of two coils of wire, typically wound around a soft iron core. The primary coil has fewer turns of wire than the secondary coil. When an alternating current (AC) is passed through the primary coil, it creates a changing magnetic field in the iron core. This changing magnetic field induces an alternating current in the secondary coil.



1. Primary Coil (L1): The primary coil is connected to a source of alternating current. It has fewer turns of wire than the secondary coil.
2. Secondary Coil (L2): The secondary coil has more turns of wire than the primary coil. It is connected to the load that requires a higher voltage.

3. Soft Iron Core: The coils are wound around a soft iron core, which helps to concentrate the magnetic field and improve the efficiency of the transformer.

4. Insulating Material: Insulating material is used to separate the coils and prevent short circuits.

5. Terminals: The terminals of the primary and secondary coils are used to connect the transformer to the external circuit.

When a load is connected to the secondary coil, the transformer steps up the voltage from the primary to the secondary coil. This is achieved by the ratio of the number of turns in the coils (N_1/N_2), where N_1 is the number of turns in the primary coil and N_2 is the number of turns in the secondary coil.