KENYA CERTIFICATE OF BASIC EDUCATION (K.C.B.E)

MARKING SCHEME

GRADE 10: PHYSICS – TERM 1 – JANUARY 2026

SECTION A (40 Marks)

1. Definition and importance of Physics

a) **Physics:**

- ✓ Physics is the branch of science that deals with the study of matter, energy, and the interactions between them.
- ✓ It studies the laws governing motion, forces, energy, heat, light, sound, electricity, and magnetism.

b) **Importance of Physics in society:**
i. Helps in the design and manufacture of machinery, vehicles, and electronic devices.
ii. Essential for medical technology (X-rays, MRI, radiotherapy).
iii. Important in construction and engineering projects (bridges, dams).
iv. Helps understand natural phenomena such as earthquakes, weather, and tides.

2. Branches of Physics (matching)

List A	List B
i. Mechanics	B. Study of motion of bodies
ii. Thermodynamics	A. Study of heat and temperature
iii. Optics	D. Study of light
iv. Acoustics	C. Study of sound and its properties

3. Application of Physics in various fields

a) **Biology:**

- ✓ Physics explains body mechanics, blood circulation, and biomechanics of muscles and skeletons.

b) **Medicine:**

- ✓ Physics is used in medical imaging, radiotherapy, and measuring devices (thermometers, sphygmomanometers).

c) **Engineering:**

- ✓ Physics principles guide design, stress analysis, and construction of structures and machines.

d) **Agriculture:**

- ✓ Physics helps in irrigation systems, soil testing, and design of farming tools and machinery.

4. Careers related to Physics
i. Physicist / Research Scientist
ii. Mechanical / Civil / Electrical Engineer
iii. Medical Physicist / Radiologist
iv. Meteorologist / Environmental Scientist
v. Renewable Energy Specialist / Technologist

5. Pressure and knives

a) **Pressure:**

- ✓ Pressure is the force applied per unit area.
- ✓ Formula: $P = \frac{F}{A}$

b) **Sharp knife cuts more easily because:**

- ✓ It has a smaller contact area, thus applying higher pressure ($P = F/A$) on the tomato.
- ✓ Less force is needed to penetrate the surface.

c) **SI unit of pressure:**

- ✓ Pascal (Pa) = 1 N/m²

6. Pressure in liquids

a) **Factors affecting pressure in liquids:**
i. Depth of the liquid (h)
ii. Density of the liquid (ρ)
iii. Acceleration due to gravity (g)

b) **Diver feels more pressure at depth because:**

- ✓ Pressure increases with depth according to $P = \rho gh$
- ✓ Greater depth → greater weight of water above → higher pressure

7. Atmospheric pressure and gas laws

a) **Atmospheric pressure:**

- ✓ The pressure exerted by the weight of air in the atmosphere on a surface.

b) **Bottle collapses at sea level because:**

- ✓ Pressure inside the bottle is lower than the higher atmospheric pressure at sea level, crushing the bottle.

c) **Bicycle pump operation (backstroke):**

- ✓ Pulling back creates a vacuum inside the pump cylinder.
- ✓ Air pressure outside forces air into the cylinder through the inlet valve.
- ✓ One-way valves ensure air moves into the tyre but not back into the pump.

d) **Pressure–temperature relationship (fixed volume):**

- ✓ Pressure is directly proportional to temperature ($P \propto T$) at constant volume.

8. Pressure calculations

a) **Rectangular block:**

Given: $m = 8\ \text{kg}, A = 0.02\ \text{m}^2, g = 9.8\ \text{m/s}^2$

$$F = mg = 8 \times 9.8 = 78.4N$$

$$P = F/A = 78.4/0.02 = 3920\ \text{Pa}$$

b) **Liquid pressure:**

Given: $\rho = 1000\ \text{kg/m}^3, h = 5m, g = 9.8\ \text{m/s}^2$

$$P = \rho gh = 1000 \times 9.8 \times 5 = 49{,}000\ \text{Pa}$$

c) **Pressure at base with kerosene and water:**

- ✓ Water column: $P_w = \rho gh = 1000 \times 9.8 \times h$
- ✓ Kerosene column: $P_k = 800 \times 9.8 \times h$
- ✓ Total pressure = Atmospheric + liquid pressure
- ✓ Example: For h = 1 m, water → $9.8 \times 10^3 Pa$, kerosene → $7.84 \times 10^3 Pa$, total ≈ $1.103 \times 10^5 Pa$

SECTION B (60 Marks)

9. Pascal's Principle & hydraulics

a) **Pascal's Principle:**

- ✓ Pressure applied to a confined fluid is transmitted equally in all directions.

b) **Hydraulic lift explanation:**

- ✓ Small piston applies force → pressure transmitted through fluid → large piston moves up lifting the car.
- ✓ Diagram labels: small piston, large piston, fluid, car, force direction.

c) **Calculations:**

i) Pressure transmitted:

$$P = F/A = 40/0.01 = 4000\ \text{Pa}$$

ii) Force on large piston:

$$F = P \times A = 4000 \times 0.5 = 2000N$$

d) **Devices using pressure differences:**

i. **Drinking straw:**

- ✓ Air pressure outside > inside → liquid rises when suction creates lower pressure inside straw.

ii. **Bicycle pump:**

- ✓ Reduces internal pressure → external air moves into tyre.

iii. **Syringe:**

- ✓ Pulling plunger reduces pressure inside → liquid enters; pushing plunger increases pressure → liquid expelled.

10. Syphon and fluid pressure

a) Pressure difference for syphon:

$$P = \rho gh = 1000 \times 9.8 \times 2.5 = 24{,}500Pa$$

b) Force on tractor tyre:

$$F = P \times A = 2.5 \times 10^5 \times 0.8 = 2.0 \times 10^5 N$$

c) **Hydraulic brake system:**

- ✓ Force applied on pedal → pressure transmitted through brake fluid → brakes engage wheel pistons equally.

d) **Pressure in liquids increases with depth because:**

- ✓ Greater depth → more liquid above → higher weight → $P = \rho gh$

e) Pressure calculations in tank:

i) $P = \rho gh = 1000 \times 9.8 \times 0.2 = 1960Pa$

ii) At bottom (0.6 m): $P = 1000 \times 9.8 \times 0.6 = 5880Pa$

f) Effect of:

i) **Density:** Higher density → higher pressure at bottom ($P \propto \rho$)
ii) **Depth:** Greater depth → higher pressure ($P \propto h$)

g) Force on base:

$$F = P \times A = 5880 \times 0.3 = 1764N$$

h) **Deep-sea animals:**

- ✓ Experience higher pressures → require stronger, pressure-resistant body structures to avoid crushing.

NOTE TO FACILITATORS (TEACHERS):

The marking scheme provided is not exhaustive. Facilitators are advised to use their professional judgment when awarding marks. Any correct, relevant, and scientifically or contextually acceptable answer that demonstrates understanding of the concepts should be credited. Where examples are required, learners may provide other valid examples apart from those listed in the scheme.

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