TAIDOB COLLEGE

PRE-WASSCE PREPARATORY ASSESSMENT

PHYSICS **SS3**

1. (a) (i) Explain relative motion.

(ii) Two cars moving in opposite directions on the same straight road with velocities 80 $km\ h^{-1}$ and 60 $km\ h^{-1}$ respectively pass each other at a point. Determine the velocity of the first car relative to the second car.

(b) (i) Define force.

(ii) Classify the following forces as either contact forces or field forces: push; tension; gravitational force; electrostatic force; reaction and magnetic force.

(c) A body starts from rest and travels in a straight line for 2 s with uniform acceleration of 1 $m\ s^{-2}$. It then travels at a constant speed for some time before coming to rest with uniform retardation of 2 $m\ s^{-2}$. The total distance covered by it is 15 m.

(i) Draw and label a velocity-time graph for the motion.

(ii) Calculate the:

(α) velocity attained at the end of 2 s;

(β) total time taken for the journey.

2.(a) Name the energy transformations which occur in a functioning:

(i) car engine;

(ii) steam turbine.

(b) List **three** main features of a clinical thermometer.

(c) Explain why water becomes cooler when kept in a clay pot for some time in a room.

(d) Water of mass 0.4 kg loses 210 kJ of energy when taken from the Earth's surface to Mars of surface temperature -60 . The water temperature decreases until the water freezes. The temperature of ice formed decreases until it becomes equal to that on Mars. Calculate the temperature of the water while on Earth.

[Specific latent heat of fusion of ice $= 3.3 \times 10^5\ J\ kg^{-1}$; specific heat capacity of water $= 4200\ J\ kg^{-1}\ K^{-1}$; specific heat capacity of ice $= 2100\ J\ kg^{-1}\ K^{-1}$]

3.(a) State **two** differences between a sound wave and a radio wave.

(b) Explain why a vibrating tuning fork sounds louder when its stem is pressed against a table top than when held in air.

(c) State **two** conditions necessary for the:

(i) production of stationary wave in a medium;

(ii) formation of interference wave patterns;

(ii) occurrence of total internal reflection of a wave.

(d) A ray of light is incident on one face of an equilateral glass prism.

(i) Draw a ray diagram to show the path of the ray through the prism.

(ii) Calculate the refractive index of the glass if the angle of minimum deviation is 41°.

4. (a) State:

(i) **three** ways by which the e.m.f. of an a.c. generator can be increased;

(ii) how an a.c. generator could be modified to produce d.c.

(b) (i) Define the root mean square value of an alternating current.

(ii) Explain the term resonant frequency as it relates to series R – L –

C circuit.

(c) A particle of charge $-6\ \mu C$ released from rest in a uniform electric field E moves a distance of 5 cm. If its kinetic energy is $4 \times 10^{-3}\ J$, calculate the:

(i) work done by the electric field;

(ii) potential at its initial position;

(iii) magnitude of the electric field intensity.

5.(a) List **three** facts about the acceleration of free falling object due to gravity.

(b) List **two** objects each which may be considered as projectiles in:

(i) sports;

(ii) warfare.

(c) A ball of mass 12 g was projected vertically from the earth surface with a speed of $25\ m\ s^{-1}$. The height of the ball was determined at regular intervals as shown below.

Height H/m	Time t/s
11.25	0.5
20.00	1.0
26.25	1.5
30.00	2.0
31.25	2.5

(i) Plot a graph with height, H on the vertical axis and time ,t on the horizontal axis, starting both axes from the origin (0,0)

[Draw a smooth curve through the points]

(ii) Using the graph, determine the height of the ball at $t = 1.7\ s$.

(d) The combined mass of a bicycle and its rider is 60 kg. Calculate the magnitude of the forward force produced by the bicycle if its speed increases from 10 $m\ s^{-1}$ to 15 $m\ s^{-1}$ in 3.0 s.

[Neglect friction and air resistance]

6. (a) List **three** effects of heat on matter.

(b) Explain the following observations:

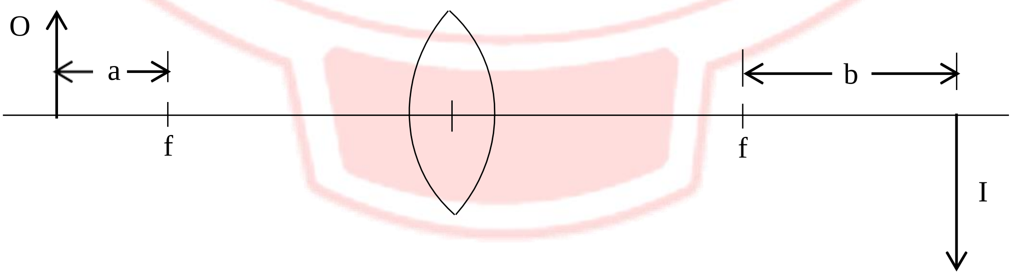
(i) a thick glass cup cracks when boiling water is poured into it but the same cup would not crack when immersed in a bath of cold water which is then heated to boiling point;

(ii) a cat runs with difficulty on a highly polished floor.

(c) (i) State pressure law.

(ii) A bottle is corked when air in it is at 20 and 76 $cm\ Hg$. The bottle is heated until the pressure is increased by 69 $cm\ Hg$. Calculate the final temperature of the air in .

7.(a) A thin converging lens of focal length, f has an object, O on and perpendicular to its principal axis. A real image I is produced by the lens as illustrated in the diagram below.



(i) Given that the principal foci of the lens are the points marked f, use the lens formula to show that f = ab.

(ii) If a $= 16\ cm$ and b $= 25\ cm$, determine f.

(iii) Determine the magnification of the image.

(b) Explain the following terms:

(i) principal focus;

(ii) optical centre;

(iii) focal length.

8.(a) (i) What is a lightning conductor?

(ii) Why are lightning conductors used to protect tall buildings from the undesirable effect of thunderstorm?

(b) Draw the lines of force associated with the following situations;

(i) two unlike charges of equal magnitude;

(ii) a positive charge in isolation;

(iii) two parallel plates carrying unlike charges of equal magnitude.

(c) Two equal point charges exert a force F_1 on each other when they are $5 \times 10^{-2}\ m$ apart in a vacuum. Determine the distance between the charges if the force is to be doubled.

9. (a) (i) State the laws of refraction.

(ii) Describe how you would determine the focal length of a converging lens given a converging lens, lens holder, a ray box with cross wires, a metre rule, and a screen.

(b) The near point of a man's vision is 35.0 cm.

(i) What type of defect of vision is he suffering from?

(ii) Illustrate with a suitable ray diagram the formation of the image of an object placed at this point.

(c) An air column in a closed tube set into vibration, produces a fundamental note of frequency 500 Hz. Calculate its length.

[Speed of sound in air $= 340\, m\, s^{-1}$]

10. (a) (i) What is meant by a machine?

(ii) List **four** types of machine.

(b) Explain the working principle of a refrigerator.

(c) A pulley system with a velocity ratio of 6 is used to raise a load of 80 N through a vertical height of 16 m,

(i) draw a diagram of this arrangement.

(ii) calculate the effort required in the system, if its efficiency is 70%.

(iii) calculate the work done by the effort.