ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

PHYSICS   **9188/3**
PAPER 3

NOVEMBER 2009 SESSION   50 minutes

Additional materials:
  Answer paper
  Electronic Calculator and / or Mathematical tables
  Ruler (mm)

TIME 50 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **three** questions.

Question 1 is compulsory.
Answer any other **two** from the remaining questions.

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.
All working for numerical answers must be shown.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
You are reminded of the need for good English and clear presentation in your answers.

Candidates are advised to spend 25 minutes on **question 1**.

This question paper consists of 7 printed pages and 1 blank page.

[Turn over

*Answer **question 1** and **any other 2** from the remaining questions.*

1   **(a)**   **(i)**   Define *work*.

(ii)   Derive from the definition in **(i)**, the equation for the change in potential energy near the earth's surface.

(iii)   A cubic wooden block of mass 3.0 kg and side 0.75 m, lying horizontally on one of its faces is tilled through 30° as in **Fig. 1.1**.
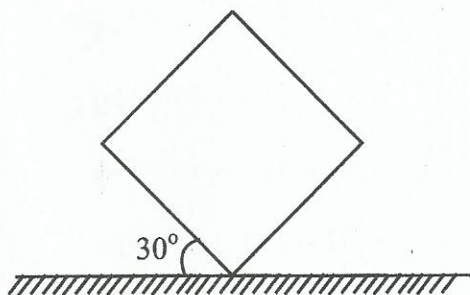

Fig. 1.1

Determine the change in potential energy.   [7]

(b)   **(i)**   Distinguish between a transverse and a longitudinal wave.

(ii)   Explain with the aid of a diagram, why in progressive transverse waves, crests and troughs move away from the source of disturbance.

[7]

(c)   **(i)**   State **three** base quantities and their corresponding units.

(ii)   Express **the volt** in its base units.

[6]

2   **(a)**   **(i)**   State the universal law of gravitation.

(ii)   Give **one** difference and **one** similarity between this law and
Coulomb's law.   [4]

(b)   Calculate the work done in taking a 5.0 kg mass from the Earth's surface
to a point where the earth's gravitational effect is negligible.

[Assume that the earth is a uniform sphere of radius 6 400 km and mass
6.0×10^{24} kg.]   [3]

(c)   A satellite of mass, m, is placed in an orbit such that it appears stationary
above a given point on the Earth.

Show that the radius of the satellite's orbit is given by

$r = 574 \sqrt[3]{GM_E}$, where M_E is the mass of the Earth and G the universal
gravitational constant.   [3]

3 **(a)** Explain the terms

    (i)   angular frequency, and

    (ii) · phase difference.

    [2]

    (b) The graphs in **Fig. 3.1** are showing oscillations of carbon atoms.
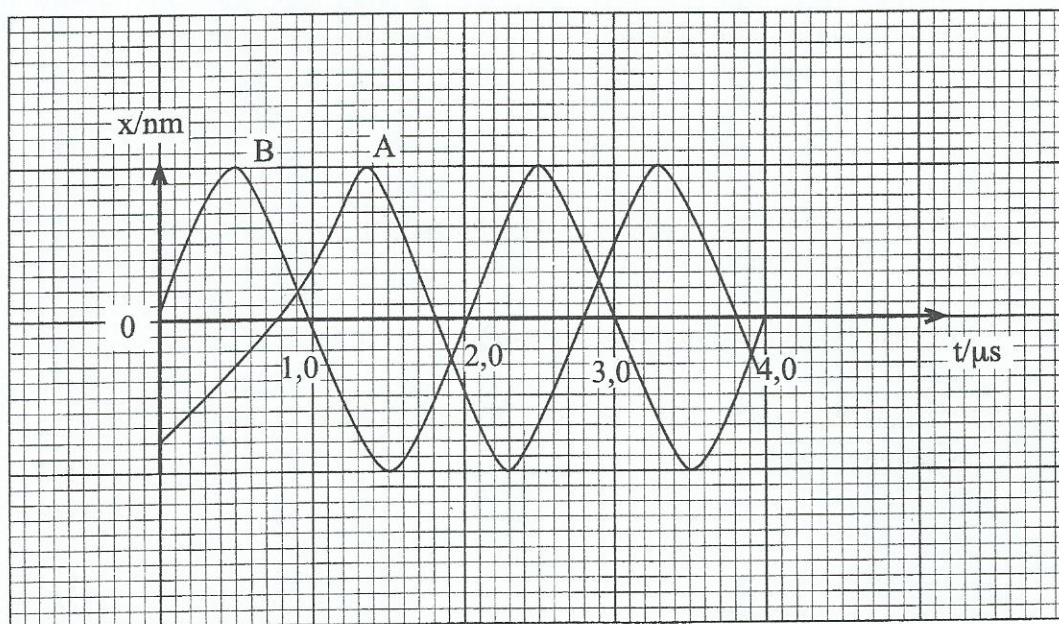

Fig. 3.1

    (i) State with a reason the oscillation that is leading.

    (ii) Calculate the phase difference in radians between the two oscillations.   [5]

    (c) Sketch a graph of velocity against displacement for one of the oscillating atoms.   [3]

4   **(a)**   Define *linear momentum* and *impulse*.   [2]

(b)   Use Newton's third law to derive the principle of conservation of
momentum.   [4]

(c)   Two motor vehicles **A** and **B** are moving along a horizontal straight
road in opposite directions. Vehicle **A** of mass 3 500 kg is moving
with a speed of 14 m/s and vehicle **B**, mass 2 000 kg is moving with
a speed 20 m/s. They collide and move together.

Calculate the change in kinetic energy.   [4]