MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCE

DEPARTMENT OF APPLIED SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

FIRST YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY

APH 105 – ELEMENTS OF PHYSICS I

DURATION: 2 HOURS

DATE: 18TH APRIL, 2018

TIME: 9.00 – 11.00 A.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Distinguish between scalar and vector quantities giving one example of each (3 marks)

b) What are:

   i. Like vectors (1 mark)

   ii. Orthogonal unit vectors (2 marks)

c) Distinguish between statics and dynamics as used in mechanics (2 marks)

d) State the law of conservation of momentum (1 mark)

e) A 300g bird flying at a speed of 6 m/s sees a 10g insect heading straight towards it with a speed of 30m/s. The bird opens its mouth and the insect flew in. what is the bird's speed immediately after swallowing? (4 marks)

f) A car is accelerating uniformly as it passes two checkpoints that are 30m apart, the time taken between the checkpoints is 4 s and the car's speed at the first checkpoint is 5 m/s. Find the car's acceleration and speed at the second checkpoint (6 marks)

g) State three factors that affect the speed of wave in a stretched string (3 marks)

h) A wave has angular frequency 30 rads/s and wavelength 2m. what are its

   i. Wave number (2 marks)

   ii. Wave speed (3 marks)

i) Briefly discuss Hygen's principle (3 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) A tennis player receives a shot with the ball (0.05 kg) travelling horizontally at 50.0 m/s and returns the shot with the ball travelling horizontally at 40.0 m/s in the opposite direction.

   i. What is the impulse delivered to the ball by the racquet? (5 marks)

   ii. What work does the racquet do on the ball? (5 marks)

b) A railroad car of mass 2.5×10^4 kg is moving with a speed of 4 m/s. It collides and couples with three other coupled railroad cars, each of the same mass as the single car and moving in the same direction with an initial speed of 2 m/s.

   i. What is the speed of the four cars after the collision? (5 marks)

   ii. How much mechanical energy is lost in the collision? (5 marks)

QUESTION THREE

a) Define the following terms a used in projectile notion (3 marks)

   i. Trajectory

   ii. Angle of projection

   iii. Range

b) A stone is thrown straight upward with an initial speed of 40 m/s. It is caught on its way down at a point 8 m above where it was thrown.

   i. How high did it rise? (3 marks)

   ii. How fast was it moving when it was caught (3 marks)

   iii. How long did the trip take? (3 marks)

c) The siren on an ambulance has a characteristic frequency of 1200 Hz. What is the frequency heard by stationary observer if the ambulance is moving at 120 km/h

   i. Toward the observer (4 marks)

   ii. Away from the observer (4 marks)

   Take speed of sound in air to be 340m/s.

QUESTION FOUR

a) A soccer ball is kicked from the ground with initial speed of 19.5 m/s at an angle of 45°. A player 55m away in the direction of the kick starts running to meet the ball at that instant. What must be his average speed if he is to meet the ball just before it hits the ground? Neglect air resistance (6 marks)

b) A particle initially moving at a velocity u changes its velocity to v in time t. Using the given information derive the three main equations of motion for the particle (9 marks)

c) The equation of a transverse travelling wave $y = 4\ Sin\ 2\pi\ (5x - 2ot)$ where x and y are in meters and t in seconds. Calculate the:

   i. Wavelength (3 marks)

   ii. Period (2 marks)