



UGANDA BUSINESS AND TECHNICAL EXAMINATIONS BOARD

Business and Humanities Certificate Examinations

NOV-DEC SERIES

PROGRAMME

CERTIFICATE IN INFORMATION AND COMMUNICATION TECHNOLOGY

PAPER NAME

INTRODUCTION TO ADVANCED LEVEL PHYSICS I

PAPER CODE

CAP III

YEAR I SEMESTER I

2½ HOURS

THURSDAY, 5TH DECEMBER, 2019

INSTRUCTIONS TO CANDIDATES

1. This paper consists of **two** sections **A** and **B**.
2. Section **A** is compulsory and carries 20 marks
3. Section **B** consists of **six** questions. Answer only **four** questions from this section.
4. All questions carry equal marks.
5. All answers to each question should begin on a fresh page.
6. **Do not** write on the question paper.
7. All answers and rough work should be done in the official answer booklet provided.
8. Non-programmable electronic calculators may be used.
9. Read other instructions on the answer booklet.
10. Take $g = 10\text{m}^{-2}$, speed of light $3.0 \times 10^8\text{ms}^{-1}$

SECTION A - (20 MARKS)

Answer all the questions in this section.

Question One

- (a) Define the following terms as used in linear motion.
- (i) Uniform acceleration (01 mark)
 - (ii) Uniformly accelerated motion (01 mark)
 - (iii) Uniform velocity (01 mark)
- (b) (i) Sketch a velocity time graph for a body thrown vertically upwards with initial velocity $u \text{ ms}^{-1}$. (02 marks)
- (ii) Write down **three** equations of linear motion. (03 marks)
- (iii) A car accelerates uniformly from rest and acquires a velocity of 60 ms^{-1} after half a minute. Calculate the distance covered by the car during this time. (03 marks)
- (c) (i) Distinguish between scalar and vector quantities. (02 marks)
- (ii) The velocity v , of a wave in a material of Young's modulus E and density P is given by $V = \sqrt{(E/P)}$. Show that the relationship is dimensionally correct. (03 marks)
- (d) (i) Define the terms work and energy as used in Physics. (02 marks)
- (ii) A pulley is used to raise a load of 40kg through 13m in 30s. Find the average power developed. (02 marks)

SECTION B - (80 MARKS)

Answer only four questions from this section.

Question Two

- (a) (i) Define the term equilibrium. (02 marks)
- (ii) State **three** types of equilibrium. (03 marks)
- (iii) List **two** conditions for equilibrium of a rigid body. (02 marks)
- (b) (i) State Newton's laws of motion. (03 marks)
- (ii) Using the 2nd law of motion, show that the resultant force acting on a body is given by $F = ma$. All symbols carry their usual meaning. (03 marks)

- (c) A uniform ladder of mass 40kg and length 5m rests with its upper end against a smooth vertical wall and with its lower end at 3m from the wall on a rough ground. Find the magnitude and the direction of the force exerted at the bottom of the ladder. (07 marks)

Question Three

- (a) Distinguish between the following;
- (i) Speed and velocity (02 marks)
 - (ii) Displacement and distance (02 marks)
 - (iii) Acceleration and deceleration (02 marks)
- (b) A vehicle accelerates uniformly from the rest to a velocity of 80ms^{-1} in 20 seconds. It maintains this velocity for 20 seconds and finally comes to rest in another 20 seconds.
- (i) Sketch a velocity-time graph for the motion of the vehicle. (02 marks)
 - (ii) Find the total distance covered by the vehicle. (04 marks)
 - (iii) Calculate the deceleration and acceleration of the vehicle. (04 marks)
- (c) At any time t , the velocity of an object is defined as $V = (6ti + 6j)\text{ms}^{-1}$. Find the vector from;
- (i) Its displacement after 2s. (02 marks)
 - (ii) Its acceleration after 2s. (02 marks)

Question Four

- (a) Define the following terms as applied to projectile motion.
- (i) Velocity of projection (01 mark)
 - (ii) Horizontal range (01 mark)
 - (iii) Time of flight (01 mark)
- (b) A projectile is fired at an angle of 45° to the horizontal with a speed of 20ms^{-1} . Calculate;
- (i) Maximum height reached (02 marks)
 - (ii) Time of flight (02 marks)
 - (iii) Horizontal range of the projectile (02 marks)

- (c) (i) Calculate the resultant vector. (01 mark)
- (iii) **Three** forces of 35N, 40N and 20N act on a body of mass 6kg as shown in Fig.1. Find the resultant force and acceleration produced on the body. (06 marks)

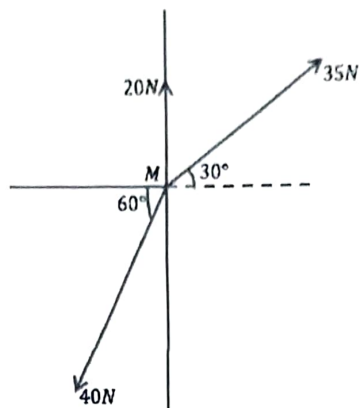


Fig. 1

- (d) State **two** examples of scalar and vector quantities. (04 marks)

Question Five

- (a) (i) Distinguish between **conservative** and **non-conservative** forces. (02 marks)
- (ii) List **three** examples of each in 5(i). (03 marks)
- (b) (i) State the law of conservation of mechanical energy. (01 mark)
- (ii) List **two** examples of mechanical energy. (02 marks)
- (iii) Identify **two** differences between inelastic and elastic collisions. (02 marks)
- (c) A bullet of mass 40g is fired from a gun at 200ms^{-1} and hits a block of wood of mass 2kg which is suspended by a light vertical string 2m long. If the bullet gets embedded in the wooden block, calculate;
- (i) The maximum angle the string makes with the vertical. (06 marks)
- (ii) Tension in the string (03 marks)
- (iii) State **one** factor on which the angle of swing depends. (01 mark)

Question Six

- (a) (i) Define the term dimensions of a physical quantity. (01 mark)
- (ii) State **two** uses of dimension. (02 marks)
- (iii) Find the dimensions of force and young's modulus. (04 marks)

- (b) The equation for the volume v of a liquid flowing through a pipe in time t under steady flow is given by $v/t = \frac{\pi r^4 p}{8\eta L}$ where;

r = radius of the pipe

p = pressure difference between the ends of a pipe

L = length of the pipe

η = co-efficient of viscosity of the liquid

If the dimension of η are $ML^{-1}T^{-1}$, show that the above equation is dimensionally consistent. (05 marks)

- (c) For stream line flow of a non-viscous incompressible fluid, the pressure p at a point is related to the height (h) and velocity (v) by the equation

$(p - a) = \rho g(h - b) + \frac{1}{2}\rho(v^2 - d)$. Where a , b and d are constants and ρ is the density of the fluid. Given that the equation is dimensionally consistent, find the dimensions of a , b and d . (04 marks)

- (d) Distinguish between fundamental and derived physical quantities. Give **two** examples of each. (04 marks)

Question Seven

- (a) (i) Define friction force. (01 mark)
 (ii) State laws of friction. (02 marks)
 (iii) List two advantages and disadvantages of friction force. (02 marks)
 (iv) Identify **two** ways in which friction force can be reduced? (02 marks)
- (b) A car of mass 1000kg moves along a straight surface with a speed of $20ms^{-1}$ when the brakes are applied steadily the car comes to rest after travelling 50m. Calculate the;
 (i) Coefficient of friction between the surface and the tyres. (05 marks)
 (ii) Time taken for the car to come to rest. (03 marks)
- (c) A stone of mass 4kg is released from a height h with a potential energy of 480J. Find the
 (i) Value of h . (02 marks)
 (ii) Velocity with which it hits the ground. (03 marks)

END