

**KABARAK**



**UNIVERSITY**

**EXAMINATIONS**

**2008/2009 ACADEMIC YEAR**

**FOR THE CERTIFICATE OF PRE- UNIVERSITY  
PHYSICS**

**COURSE CODE: PPHYS 021**

**COURSE TITLE: BASIC MECHANICS AND WAVES**

**STREAM: SEMETER TWO**

**DAY: WEDNESDAY**

**TIME: 9.00 – 11.00 A.M.**

**DATE: 25/03/2009**

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**INSTRUCTIONS:**

1. Answer Question 1 and any other TWO questions.
2. Question 1 carries 40 marks and the other questions carry 15 marks each.
3. Assume  $\pi = 3.14$ ,  $g = 9.8 \text{ m/s}^2$  and the speed of light ( $c$ ) =  $3 \times 10^8 \text{ m/s}$ .

**PLEASE TURN OVER**

**Question ONE (40 Marks)**

- a) A car travels at a constant speed of 20m/s. What distance will it have covered after one hour?  
(3 marks)
- b) A stone is dropped from rest from a height of 25m above the ground. Ignoring the effects of air resistance, how much time will the ball take before hitting the ground?  
(3 marks)
- c) An objects accelerates from rest at a constant rate of  $2 \text{ m/s}^2$  for 5 s;  
i. what is the speed of the car after the 5 s?  
ii. how far has the car travelled within this time?  
(5 marks)
- d) State the law of conservation of energy.  
(3 marks)
- e) What is the efficiency of machine that uses an input energy of 100 joules to do a work of 75 joules?  
(3 marks)
- f) A 30 kg crate is at rest on a horizontal surface. If the coefficient of static friction between the crate and the surface is 0.69, what horizontal force is required to get the crate moving?  
(4 marks)
- g) Find the rectangular components of a velocity vector that has a magnitude of 10 m/s and is oriented at an angle of 30 degrees above the positive x-axis.  
(4 marks)
- h) A 100 kg athlete runs with a velocity of 4 m/s straight down the field. A machine gun on the other hand fires a 1 kg shell with a velocity of 450 m/s. Which of the two has a greater momentum; the athlete or the shell?  
(3 marks)
- i) The frequency of visible light is approximately  $5 \times 10^{14}$  Hz. What is the approximate wavelength of the light?  
(3 marks)
- j) Differentiate between compressions and rarefactions as used in waves and state the type of waves that depict them.  
(5 marks)
- k) Differentiate between elastic and inelastic collisions and give an example that best describes each case.  
(4 marks)

**Question TWO (15 Marks)**

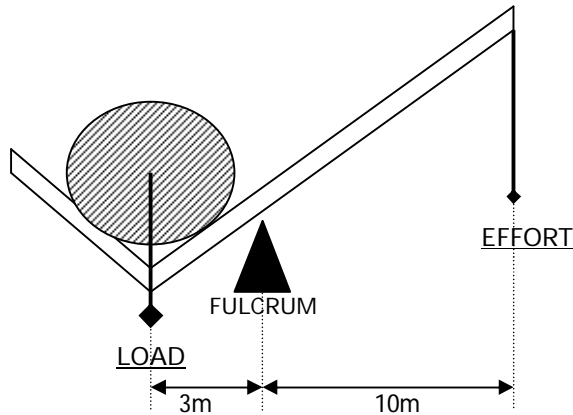
- l) A 90 kg athlete runs with a velocity of 5 m/s straight down the field. A machine gun on the other hand fires a 1 kg shell with a velocity of 450 m/s. Which of the two has a greater momentum; the athlete or the shell? State why.  
(4 marks)
- a) When a string of length 12 m is fixed at both ends and made to vibrate, it forms a standing wave of six harmonics. Calculate the wavelength of the standing wave  
(4 marks)
- m) Briefly explain how sound waves travel between a source of sound e.g. a radio's speaker and the ear of a listener. Explain also how the listener is able to pick up the sound.  
(7 marks)

**Question THREE (15 Marks)**

- n) Suppose someone in your physics class says that it is possible for a rigid body to undergo both translational motion as well as rotational motion at the same time. Would you agree? If yes, give an example. If no, state why.  
(5 mark)
- o) A hot-air balloon with a mass of 500 kg ascends at a constant rate of 1.5 m/s for 20 seconds. How much work is done by the upward force pushing the balloon upwards?  
(4 marks)
- a) An empty bus at a bus-stop has of mass of 6000kg. If 40 passengers with an average mass of 60 kg each board the bus and the loaded bus travels at a constant velocity of 5m/s. Calculate its;  
i. Kinetic energy  
ii. Momentum  
(6 marks)

**Question FOUR (15 Marks)**

- a) Calculate the mechanical advantage of the system below.



(3 marks)

- p) A metallic ball of mass 0.5 kg is attached to one end of a rope. If you swing the ball in a circular manner such that the centre of mass of the ball is located 1 metre from the point of rotation, what would be the angular momentum of the ball if it is travelling at a linear velocity of 5m/s? Assume the rope has zero mass.

(5 marks)

- q) A wheel spins at a rate of 30 revolutions per minute (rpm). Calculate the angular velocity of the wheel in radians per second. Do all the points on the wheel have the same value of angular velocity?

(7 marks)