

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION

SCIENCE

COURSE CODE: PHYS 111

COURSE TITLE: MECHANICS

STREAM: SESSION I

DAY: SATURDAY

TIME: 2.00 – 4.00 P.M.

DATE: 28/11/2009

INSTRUCTIONS:

Answer ALL questions in SECTION A and any Four (4r in SECTION B)

PLEASE TURN OVER

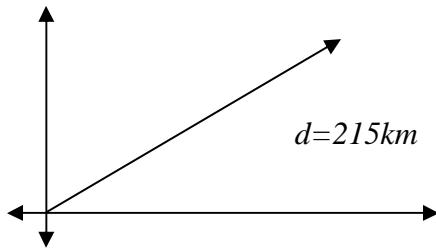
SECTIONS A (22marks)

1. a) Differentiate between a VECTOR and a SCALAR (3marks)

b) Show

- i. Vector Addition
- ii. Commutation law
- iii. Associative law

c) A small airplane leaves an airport on an overcast day and is later sighted 215km away in a direction making an angle of 22° East of North. How far East and North is the airplane from the airport when sighted (3 marks)



d) State Newton's laws of motion (3Marks)

e) Differentiate between Instantaneous velocity and speed (2marks)

f) Spotting a police car you brake your car from a speed of 100km/h to a speed of 80km/h during a displacement of 88km at a constant acceleration; (3marks)

- i. What is the acceleration?
- ii. How much time is required for the given deceleration?

g) Define the following: (1 mark)

a) Project motion:

b) Linear motion:

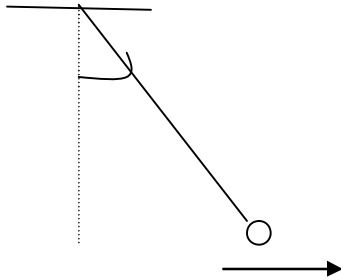
h) When does a force do no work? (2 marks)

i) State any four conservation laws? (2marks)

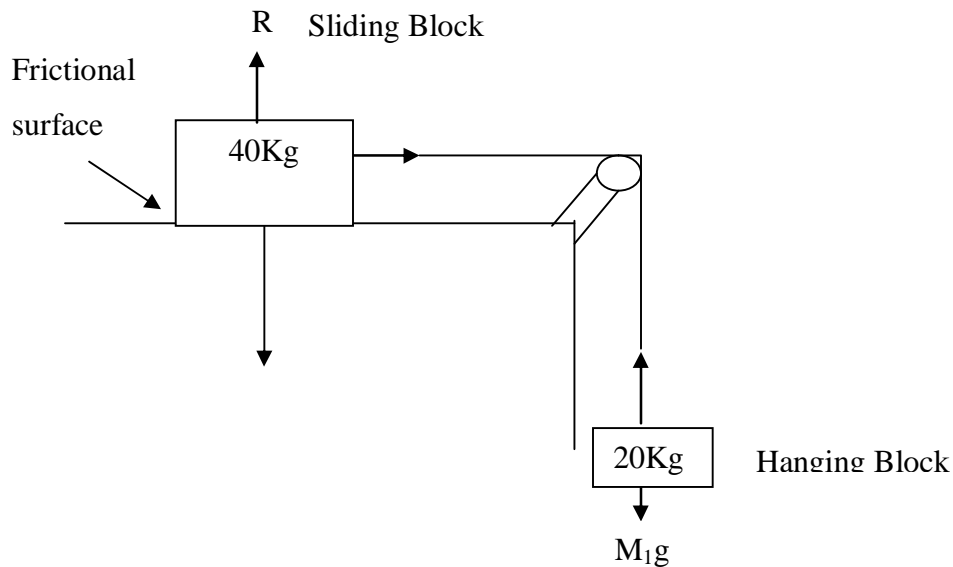
j) State the Keplers laws of planetary motion. (3marks)

SECTION B

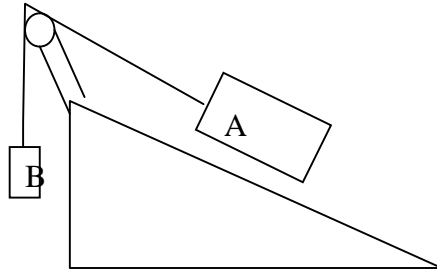
- 2) A ball of weight 0.8N hangs from the end of a string. When wind is blowing it exerts a horizontal force on the ball which moves until the string makes an angle of 30° with the vertical as shown below. Find the force exerted by wind on the ball and the tension in the string when wind is blowing. (12marks)



- 3) i) A block of mass 40 Kg resting on a table is connected by a weight string to another block of mass 20Kg as shown above . If the system remains at rest: (6marks)
- What is the coefficient of friction of the table?
 - Find tension in the string?



- b) Two blocks are connected over a mass less pulley as shown below. The mass of block A is 10Kg and the coefficient of kinetic is 0.20. Block A slides down at constant speed. What is the mass of the block B? (6marks)



- 4) A soccer player kicks the ball on an angle of 42° from the horizontal with speed of 50ms^{-1} . Assume that the ball moves in a vertical plane and that air resistance is negligible: (12marks)
- Find the time t at which the ball reaches the highest point of its trajectory.
 - How high does the ball go?
 - What is the range of the ball and how long it is in the air?
 - What is the velocity of the ball as it strikes the ground? $g = 9.8 \text{ ms}^{-1}$.
- 5) i) A lawn mower blade has a rotation rate of 3700 revolutions per minute and a radius of 0.25m. What is the velocity (V) at the tip of the blade (6marks)
- ii) A body moving along the x-axis is subject to a force repelling it from the origin, given by $F = kx$. (6marks)
- Find the potential energy function $U(x)$ for the motion and write down the conservation energy condition.
 - Describe the motion of the system and show that this is the kind of motion we would expect near a point of unstable equilibrium.
- 6) a) Derive the Newton's equation of motion (9marks)
- b) The velocity of a car is retarded from 10m/s to 4m/s in 2 seconds. What is its acceleration? (3marks)