ABIA STATE UNIVERSITY, UTURU
DEPARTMENT OF PHYSICS
FIRST SEMESTER 2013/2014 EXAMINATIONS
PHY 101 GENERAL PHYSICS 1

TIME ALLOWED: *2 HOURS*

INSTRUCTION: ATTEMPT *ALL* QUESTIONS

1. Define the terms: fundamental and derive quantities giving an example of each.
2. Convert 450KJ/hr to watts.
3. **Newton's law of universal gravitation is given by** $F = \frac{GM_1M_2}{R^2}$ **where F is the force of attraction between the masses** M_1 **and** M_2. Compute the dimension of gravitation constant G
4. From the above equation, compute the unit of G in S.I units.

The velocity of a body is given as $V(t) = \alpha t + \beta t^2 + \Upsilon t^3$

5. Find the dimensions of α, β and Υ
6. Find the units of α, β and Υ

Given two vectors $\mathbf{a} = 9i + j - 4k$ and $b = 3i - 7j + 5k$; find

7. The Magnitude of **a** and **b**
8. The Dot product of the two vectors **(a.b)** and cross product of the two vectors **(a x b)**
9. The sine angle between **a** and **b**
10. The cosine angle between **a** and **b**
11. Show that the two vectors are mutually perpendicular
12. A car is travelling at 80km/hr when the driver notices that there is an accident on the other side of the road. How far does the car travel during the two seconds of time that the driver glances at the accident?

A particle moves according to the position function, $X(t) = at^2 + bt^3 + ct^4$ **where** $a = 2m/s^2$, $b = -4m/s^3$ **and** $c = 18m/s^4$

13. Determine its velocity at $t = 3.5s$
14. What is the acceleration at $t = 5s$
15. Differentiate between static friction and dynamic friction
16. Give two advantages and disadvantages of friction respectively.
17. An object of mass 13kg rests on a frictionless horizontal surface. How large an acceleration will it undergo if a horizontal force of 15N acts on it?

A net force of 40N acts on a 6kg object

18. What acceleration does the object have?
19. Determine how far the object travels, starting from rest to acquire a speed of 7m/s.

10 men were engaged in a tug-of-war, five on each side. If each man exerts a force of 100N on the rope, what is

20. The tension in the central part of the rope between the teams?
21. The tension in the string between the first two and the last two members of each team.

22. A phonograph turn table consists of solid circular plate, 20cm in diameter and of mass 4.5kg. The turn table is rotating at 40rpm when the motor is shut off. A time of 90seconds is required for the turn table to come to rest. What is the constant angular acceleration of the phonograph?

23. The angle turned through by the flywheel of a generator during the time interval t is given by $\theta = bt^2 - ct^3 + dt^5$. Where b,c and d are constants. What is the expression for its angular velocity and acceleration?

A uniform disc rotating about a vertical axis was observed to have an initial angular velocity of 5revs per seconds. After the observer had counted 20 revolutions he observed that the speed had gone up to 10revs per seconds. Calculate:

24. (a) The angular acceleration (b) The time required to complete the 20revs

25. (a) The time taken to start from rest and attain 5revs per second

(b) The number of revolutions required to go from rest to 5revs per seconds

26. An object constrained to move along the x-axis is acted upon by a force F(x) where $\alpha = 6N/m$, $\beta = -4N/m$, given that $F(x) = \alpha x + \beta x^2$ while the object is observed to proceed directly from x= 1m to x = 2m. How much work was done on the object by the force?

27. Find the work (in joules) required to raise 2040kg of roofing material from ground to the top of a building 10m high.

The man pushes a box of 40kg up incline of 15^0, if the man applies a horizontal force of 200N and the box moves up the plane a distance of 20m at a constant velocity and the coefficient of friction is 0.20, find:

28. (a) Workdone by the man on the box (b) Workdone against friction

29. State the law of conservation of momentum

30. A 900kg cannon fires 100kg shells with muzzle velocity of 75m/s. calculate the recoil velocity of the cannon relative to the ground.

31. Two masses, m and 3m approach each other along a path at right angles to each other. After collision, they stick together and move off at 3m/s at an angle of 47^0 to the original direction of the mass m. What were the initial speeds of the two particles?

32. The radius of the moon is one-eight, and its mass is one-thirty six of the earth respectively. If the acceleration due to gravity of the earth is $9.8m/s^2$. What is the value of acceleration due to gravity of the moon.

33. A wheel 1.8m in radius undergoes rotation at a constant angular acceleration of $20rad/sec^2$, its angular velocity being 4rad/sec. Determine the linear velocity and linear acceleration of a point on the rim at t= 2sec

34. A mass of 20kg is suspended from the end of a steel rod of length 4m and radius 2mm. What is the elongation (change in length) of the rod beyond its original length? (take young modulus = $120N/m^2$)

35. A 6N force is applied to the plunger of a hypodermic needle.

(a) If the diameter of the plunger is 2.0cm and that of the needle is 0.40mm with what force does the fluid leave the needle? (b) What force on the plunger would be needed to push fluid into a vein where the gauge pressure is 20mmhg? (take 1mmhg = $133N/m^2$)

DEPARTMENT OF PHYSICS

2019/2020 FIRST SEMESTER EXAMINATION

PHY 101: GENERAL PHYSICS I

INSTRUCTIONS: Answer question one and any other four Questions.

TIME: 2hrs

1. a) Write the multiple of the following , Nano, Exa, Atto, Pico, Hecto, Tera

b) Define the following: (i) Average speed (iv) instantaneous acceleration (v) SI unit

c) Suppose two vectors **P** and **Q** with magnitudes 50N and 60N are acting at right angles to each other find the magnitude and direction of the resultant vector.

d) i) State the law of inertia (ii) A block of 20kg mass is pulled horizontally by a force of 10N along a frictionless floor. Find the acceleration of the body.

e) Write 4 forms of energy and state the principle of conservation of energy.

g) State the principle of conservation of linear momentum. Write down the mathematical expression of this law in two dimensions (x and y).

h) (i) Give two examples of structures that are said to be in static equilibrium. (ii) what is damped oscillation.

i. Write down the mathematical expression of efficiency, Hookes law, coefficient of restitution. Calculate the force constant of a rubber stretched 0.15m with a force of 12N.

j) Define density. Write down two characteristics pressure in liquids.

k) Write down three categories of equilibrium of an object. (30 marks)

2. (a) State 3 applications of dimensional analysis. (3 marks)

(b) consider a small ball of radius falling through a viscous liquid of viscosity η with a velocity v. Derive the exact form of relation between the viscous force F experienced by the ball and r, η, and v given that

$$F = Kr^x \eta^y v^z$$

where K is a dimensionless constant. (7 marks)

3. (a) Given two vectors: $\boldsymbol{a} = i + 2j - 3k$, $\boldsymbol{b} = 2i - 3j + 4k$
. Calculate (i) $\boldsymbol{a} - b$ (ii) $(3\boldsymbol{a} + 2\boldsymbol{b})$ (5 marks)

(b) A stone is thrown with a velocity of 5 ms^{-1} at an angle of 30° to the horizontal. Calculate the time of flight T, maximum height H and range R. (Take g = 10ms^{-2})
(5 marks)

Dr. Hebron Cares !!

Conveniently

4. (a) Mathematically define moment of a couple
(2marks)

(b) A car of mass 4kg undergoes a constant horizontal acceleration of 3 m/s^2. Calculate the resultant horizontal force acting on the body. What will be the resultant force on the body when it moves with a uniform velocity of 6 m/s?
(3marks)

(c) Define the following terms (i) Perfectly elastic collision (ii) Centre of gravity (iii) Work (iv) mechanical advantage (v) Impulse.
(5marks)

5. (a) State 3 advantages of friction
(3marks)

(b) A mass of 2kg is attached to the end of a vertical wire of length 2m and diameter 2mm extend the wire by 1mm. calculate the Young's modulus of the wire.
(5marks)

(c) List the energy transformation in i) a refrigerator ii) moving vehicle (2marks)

6. (a) What is the difference between circular and harmonic motion
(2marks)

(b) A pump is used to spray water from a pool to form a fountain. Determine the minimum power of the pump if it ejects 60kg of water per minute and the spray reaches an average vertical height of 5m. (Assume mass of 1 cm^3 of water = 1 kg; g = 10 m/s^2)
(3marks)

c) What is the weight of a 85kg Astronaut a) on earth (g = 10 m/s^2) and b) on the moon (g = 1.7 m/s^2)
(4marks)

d) Define a machine
(1mark)

7. a) A particle of mass 0.4kg is subjected to two forces $F_1 = 2i - 4j$ and $F_2 = -2.6i + 5j$ in Newton. If the particle starts from rest at the origin at t = 0, Find its position and velocity at t = 1.6 s.
(6marks)

b) Write the velocity ratio of the following types of machines i) Wheel and axle ii) inclined plane iii) Hydraulic Press iv) Screw.
(4marks)

Dr. Ttebron Cares!

Pressure increases with depth of liquid

ABIA STATE UNIVERSITY, UTURU
DEPARTMENT OF PHYSICS
2020/2021 FIRST SEMESTER EXAMINATION
PHY 101: GENERAL PHYSICS I

INSTRUCTIONS: ATTEMPT ANY SEVEN (7) QUESTIONS. **TIME: 2hrs**

1. a) Write down any 4 fundamental quantities and their units (4 marks)
b) What are the multiples of the following (i) Femto (ii) Pico (iii) Mega (iii) Tera (4 marks)
c) Using dimensional analysis, derive the unit of Pressure (2 marks)

2. a) Define vector and scalar quantities and give 3 examples for each. (5 marks)
b) If vector $\boldsymbol{a} = \boldsymbol{i} + 2\boldsymbol{j} - 3\boldsymbol{k}$ and $\boldsymbol{b} = 2\boldsymbol{i} - 3\boldsymbol{j} + 4\boldsymbol{k}$, find vector c such that $2\boldsymbol{a} - 3\boldsymbol{b} + \boldsymbol{c} = \underline{0}$ (5 marks)

(3.a) i. What is the difference between average velocity and instantaneous velocity? (2 marks)
(ii) . A car travels with a certain average velocity in half a minute and covers 900m. Find the average velocity. (2 marks)
b) A stone is thrown with a velocity of 5 ms^{-1} at an angle of 30^0 to the horizontal. Calculate the (i) time of flight (ii) maximum height attained and (iii) range (take g = 10 m/s^2). (6 marks)

4. a) State the following laws (i) Newton's second law (ii) Newton's gravitational law (iii) Kepler's third law of planetary motion. (6 marks)
(b) A block of mass 20kg is pulled with a force 10N; find the acceleration of the block if (i) the block is pulled horizontally (ii) if the pulling force is acting at an angle 30^0 with the horizontal. (4 marks)

5. (a) i) State the law of conservation of energy (ii) Write down 3 forms of energy. (4 marks)
b) Determine the kinetic energy of a girl of mass 40kg running with a velocity of 3m/s. (2 marks)
c) (b) A block and tackle pulley system with velocity ratio 4 is 20% efficient. Calculate (i) the mechanical advantage (ii) the effort that can support a load of 80N. (4 marks)

6. a) i. Define the center of mass of a system. (ii) Locate the centre of mass of three particles m_1 =5.0kg, m_2 =7kg and m_3 = 10kg located at (4, 3), (2, 5) and (-1, 2) respectively, coordinates in metres. (6 marks)
b) i. State the law of conservation of linear momentum. (ii) A car of mass 1200 kg travelling at 10 m s^{-1} collides with a stationary car of mass 1000 kg. If the cars lock together find their combined speed. (4 marks)

7. a) (i) State the conditions for a rigid body to be in equilibrium (ii) Give two examples of structures that are said to be in static equilibrium. (4 marks)

b) Define friction, write down three advantages of friction and two different ways friction can be reduced. (6 marks)

8. (a) i. Write down 2 differences between weight and mass. (ii) What is the weight of 78kg object on earth ($g = 9.8\ ms^{-2}$) and on the moon? ($g = 1.7ms^{-2}$) (5 marks)

(b) i. Give two examples of a conservative force field. (ii) A car of mass 500 kg moving with a forward acceleration of 6 m/s^2 is acted upon by a constant resistive force of 800 N. Calculate the force exerted from the engine to maintain this forward acceleration. (5 marks)

9. a) i. Write down the mathematical expressions of the following (i) Hooke's law (ii) Tensile stress (iii) Tensile strain. Calculate the force constant of a rubber stretched 15cm with a force of 12N. (5 marks)

(b) i. Define impulse and momentum (ii) A body of mass 6kg moving with a speed of 20m/s is suddenly hit by another body moving in the same direction thereby changing the speed of the former body to 50m/s. What is the impulse received by the first body? (5 marks)

ABIA STATE UNIVERSITY, UTURU

DEPARTMENT OF PHYSICS

2018/2019 FIRST SEMESTER EXAMINATION

PHY 101: GENERAL PHYSICS I

INSTRUCTIONS: Answer All Questions. **TIME: 2hrs**

1. Define **Fundamental** and **Derived** units. Give **3** examples for each.

2. Arrange the following prefixes in descending order and write down their values (i) micro (ii) femto (iii) giga (iv) centi (v) pico

3. (i) State **3** applications of dimensional analysis. (ii) Using the method of dimension derive the unit of viscosity.

4. Suppose the period of oscillation **T** of a simple pendulum depends on the mass, **M** of the pendulum bob, the length **l** of the thread and the acceleration due to gravity, **g**. Use the method of dimensions to find the correct relations. Assume

$$T = KM^x L^y g^z$$

where K is a dimensionless constant.

5. The distance covered by a car at a time t is given by

$$x = 10t + 8t^4$$

with x in meters and t in seconds. Calculate the instantaneous velocity and acceleration after 2 seconds

6. Define the following: (i) Kinematics (ii) Dynamics (iii) Average speed (iv) Displacement (v) Velocity

7. A stone is thrown with a velocity of 10 ms^{-1} at an angle of 45^0 to the horizontal. Calculate the (i) time of flight (ii) maximum height attained and (iii) range (take g = 10 m/s^2).

8. An electron enters a region with a speed $5 \times 10^6 m/s$ and is slowed down at the rate of $-1.25 \times 10^{14} m/s^2$. How far does the electron travel and what is the total time taken?

9. A vector lying in the x-y plane has x-component of 12 units and y-component of 16 units. What is the magnitude of the vector and the angle it made with the horizontal

10. Given two vectors: $\boldsymbol{a} = 2i - 3j + 4k$, $\boldsymbol{b} = i + 2j - 3k$ and $\boldsymbol{c} = 3i + 6j - 4k$. Calculate (i) $\boldsymbol{a} + \boldsymbol{b} + \boldsymbol{c}$ (ii) $(\boldsymbol{a} + \boldsymbol{b}) \cdot \boldsymbol{c}$.

11. Given two vectors: $\boldsymbol{a} = i + 2j - 3k$, $\boldsymbol{b} = 2i - 3j + 4k$. Find (i) $3\boldsymbol{a} + 2\boldsymbol{b}$ (ii) $\boldsymbol{a} \times \boldsymbol{b}$.

12. If $\boldsymbol{p} = 7i - 3j + 2k$ and $\boldsymbol{q} = 4i + 5j - 3k$. Find (i) the scalar product $(\boldsymbol{p} \cdot \boldsymbol{q})$. (ii) The cosine of angle between **p** and **q**.

13. What is the weight of a 75kg astronaut (a) on earth, g = 10m/s^2 and (b) in the moon g = 1.7m/s^2

14. Define the following terms: (i) impulse (ii) inertia of a body (ii) friction.

15. A block of mass 20kg is pulled with a force 10N at an angle 30^0 with the horizontal. Find the acceleration of the block.

16. (a) State the law of conservation of linear momentum. (b) The coefficient of restitution is defined as _____.

17. (a) A boy pulled a load of mass M, 20m along a horizontal plane with a constant force of 10N applied (i) parallel to the plane (ii) in the direction of angle 60^0 to the horizontal. Calculate the work done in each case

(b) State the principle of conservation of mechanical energy.

18. (a) List 4 forms of energy. (b) A block and tackle pulley system with velocity ratio 4 is 20% efficient. Calculate (i) the mechanical advantage (ii) the effort that can support a load of 80N.

19. State the formula for calculating the velocity ratio of each of the following: (a) block and tackle pulley (b) inclined plane (c) hydraulic press (d) wheel and axle (e) screw.

20. A 5.0kg object travelling at 1.0m/s collides head on with 10.0kg object initially at rest. Determine the velocity of each object after the impact if the collision is elastic.