PHY 105
EXAM PAST QUESTIONS

RIVERS STATE UNIVERSITY NKPOLU-OROWURPKWO, PORT HARCOURT

DEPARTMENT OF PHYSICS

First Semester 2020/2021 Session Examination; Time: 2hour; Date: 16/11/2021

Course: PHY 105 - General Physics I (Take $g = 9.8m/s^2$; $G = 6.67 \times 10^{-11}Nm^2/kg^2$)

Answer 4 questions. Section A is compulsory and one question each from sections B and C.

SECTION A

1 (a). The period of a pendulum is given as; $T = 2\pi\sqrt{\frac{L}{g}}$, where g is the acceleration due to gravity and L is the length of the pendulum. A copper wire of Young's Modulus $1.35 \times 10^9 Pa$, length 7.2m and diameter 0.094cm is used as a pendulum, and a mass of 5.3kg is used as the bob. If we change the bob to a mass of 10.2kg; by how much will the period of the pendulum change? (**14marks**).

(b) A specimen oil having an initial volume of $1700cm^3$ is subjected to a pressure increase of $2.75 \times 10^6 Pa$, and the volume is found to decrease by $0.85cm^3$. (i) What is the Bulk Modulus of the material (ii) What is the compressibility of the material **(6 marks)**

2 (a). If a missile fired from a launch pad at 60° covers a distance of 3km in 5 seconds. What should be the maximum height of coverage before retardation within the range? (**10marks**).

(b). Given two vectors A = 5m∠ 120° and B = 6m ∠ 50° (i) Determine the resultant of the two vectors; (ii) Determine the other angles of the triangle (**6marks**).

(c). Dimensionally analyze (i) Acceleration (ii) Momentum (iii) Power (iv) Gravitational Constant (**4marks**).

SECTION B

3 (a). A 10,000kg Truck approaches a curved path with radius of 5000cm. Determine the speed limit if the angle of banking of the curve is 15°. (**7mks**).

(b) Object moving from the origin has a position vector of $R_{(t)} = 4t + 3t^2 + 5t^4$. Between 2sec and 6sec, (i). Determine the instantaneous velocity (ii) Determine the instantaneous acceleration. (**4mks**)

(c). (i) State the Universal Gravitation Law (**2mk**) (ii) What is measurement (**2mk**)

4 (a). A $1.44 \times 10^4 N$ train travelling with a speed of 100km/h rounds a curve whose radius is 150m.determine the magnitude of the centripetal force acting on the train. (**7marks**)

(b). If three vectors: $A = 3i - j + 2k$; $B = 2i + j - k$ and $C = i - 2j + 2k$ are perpendicular. Determine (i) $(A \times B) \times C$ (ii) $(A \times B) \cdot C$.(**6marks**)

(c). What is Sidereal time? (**2marks**).

SECTION C

5 (a). A hydraulic press contains $0.73m^3$ of oil. Find the decrease in volume of the oil when it is subjected to a pressure increase $\Delta P = 1.2 \times 10^6$ Pa. Take Bulk modulus of the oil to be 3.8×10^9 Pa. **($7\frac{1}{2}$ marks)**

(b) On a part time job, you are asked to bring a cylindrical rod of length 45cm and diameter of 4.53cm from a storage room to a mechanist. What is the weight of the aluminum rod, if the density of the rod is $3.7 \times 10^3 kg/m^3$ **($7\frac{1}{2}$marks).**

6 (a) A 95g bullet travelling at 450ms-sstrikes and is absorbed by a 100kg object. Find the speed with which the object moves off. **($6\frac{1}{2}$ marks)**

(b) (i). Two toy cars are stationary and in contact with each other. They are pushed apart by an explosion. If one having 6kg moves right with a velocity of 28m/s and the other one is 16kg that moves to the left. What is the velocity of the 16kg toy car? **($6\frac{1}{2}$ marks)**

(c) What is fluid dynamics? **(2marks)**.

Dr. I. Tamunobereton-ari & Dr. Paddy A. Ngeri

Examiners

Rivers State University

DEPARTMENT OF PHYSICS

PHY 105: GENERAL PHYSICS I EXAMINATION FOR YEAR 1 FACULTIES OF SCIENCE, AGRICULTURE, ENVIRONMENT SCIENCE STUDENTS

FIRST SEMESTER 2019/2020 SESSION **TIME ALLOWED:** 2 HRS

INSTRUCTIONS: Answer FOUR Questions in ALL. Answer One (1) Question from each Section and One (1) Question from any of the Sections.

Some Physical Constants: Acceleration due to gravity, $g = 9.8ms^{-2}$; Density of pure water, $\rho_{water} = 1 \times 10^3\ kgm^{-3}$., Universal Gravitational Constant, $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$.

SECTION A

Please answer ONLY one (1) Question in this Section

1. (a) Define Physics? [2mks]

(b) (i) State the Newton's law of Universal Gravitation and write out its formula; defining all terms. Comment on your results. [4mks]

(ii) If the gravitational force of attraction between two given masses, M_1 and M_2, is 16 units; What will the force be if the distance between the Masses is doubled? [3mks]

(c) Given the vectors **A**, **B** and **C**; show that,

$$\vec{A}\cdot\left(\vec{B}x\vec{C}\right)=\vec{C}\cdot\left(\vec{A}x\vec{B}\right)$$ [8mks]

2. (a) (i) What is Matter? [2mks]

(ii) Differentiate weight from Mass [3mks]

(b) Define impulse and hence obtain its unit by dimensional analysis. [4mks]

(c) Given the vectors, $\vec{A}=6\hat{i}+\hat{j}+2\hat{k}$ and $\hat{B}=-\hat{i}+3\hat{j}$, find the dot product of $\vec{A}$ and $\vec{B}$, and hence deduce the angle between the two vectors. [8mks]

SECTION B

Please answer ONLY one (1) Question in this Section

3. (a) State what you understand by:

(i) Hooke's Law [2mks]

(ii) Shear modulus [2mks]

(iii) Bulk modulus [2mks]

(b) Sketch the elasticity curve of a wire under load, and indicate the points of elastic limit, plasti behavior and fracture (or breaking). [5.5mks]

(c) A wire has a diameter of 4 millimeters and an original length of 2 meters. The wire is pulled by a force of 200 N. If the final length of the wire becomes 2.02 meters, calculate:

(i) Stress [2mks]

(ii) Strain [2mks]

(iii) Young's modulus [2mks]

(4) (a) Define the following terms clearly:

(i) Angular velocity of a rotating body; [2mks]

(ii) Moment of inertia of a system of rotating particles; [2mks]

(iii) Torque on a rotating body. [2mks]

(b) Given a circular disk of radius R and mass M with uniform thickness d, derive the moment of inertia of the disk, and hence show that its radius of gyration $k=\frac{R\sqrt{2}}{2}$, [8mks]

(c) A compact disc takes 4 seconds to attain its constant angular velocity of 30 cycles per minute for rest. Calculate the angular acceleration of the disc, assuming it to be constant. Give your answer in radius per second square. [3.5mks]

SECTION C

Please answer ONLY one (1) Question in this Section

5. (a) Convert:
(i) $2.56gcm^{-3}$ to kgm^{-3}. [2mks]
(ii) $7.5Nm^{-2}$ to Pascal (pa). [2mks]

(b) (i) State Pascal Law as used in hydrostatics. [2mks]
(ii) Mention 2 conditions necessary for Pascal Law to work? [2mks]
(iii) Give 2 applications which operate with the Pascal Law. [2mks]

(c) As shown in the Figure 1, a column of water, h_{water} = 40cm high supports a column of an unknown oil, h_{oil} = 31cm. What is the density (ρ_{oil}) of the unknown oil? [7.5mks]

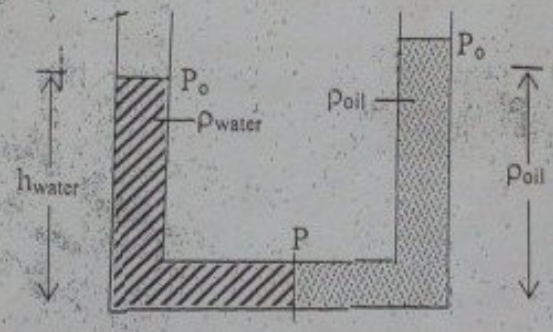

Figure 1

where ρ_{water} = density of water; ρ_{oil} = density of oil; h_{oil} = height of oil in the right limb above the datum line; h_{water} = height of water in the left limb above the datum line; P_o = atmospheric pressure; P = pressure at the bottom-datum of the tube.

6. (a) With diagrams only, illustrate:
(i) Laminar flow; [2mks]
(ii) Turbulent flow. [2mks]

(b) Give 2 examples for each of the following:
(i) Viscous liquid; [2mks]
(ii) Mobile liquid. [2mks]

(c) Draw a well labeled sketch of the forces acting on a spherical ball-bearing falling in a viscous liquid. [3mks]

(d) Castor oil at 20°C has a coefficient of viscosity $2.42Nsm^{-2}$ and a density $940Kgm^{-3}$. Calculate the terminal velocity of a steel ball bearing radius 2.0mm falling under gravity in the oil, taking the density of steel as $7800Kgm^{-3}$. [7.5mks]

ELITE MEDIA

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ELITE MEDIA

RIVERS STATE UNIVERSITY OF SCIENCE & TECHNOLOGY
FACULTY OF SCIENCE

SEMESTER: FIRST YEAR ONE OPTION B
DEPT: PHYSICS TIME 2½ Hours
COURSE: PHY. 105. GENERAL PHYSICS 1
INSTRUCTION: ATTEMPT ALL QUESTIONS WITH AT LEAST ONE QUESTION FROM EACH SECTION AND ANY OTHER QUESTION

SECTION A

1. (a) The theory of relativity enriched the subject of physics during the early 20th century. Who was the key advocate of this theory and what two theories did the propound.

(b) State three resultant consequences for each of the two theories in 1 (a) above.

(c) A moving train with speed 85km/h speed past a railway station at 0.00hrs. After 3 minutes, A lightning strikes at a point on the railroad 2km from the station in the direction of the train motion. What are the coordinates of the point at which the lightning struck as measured by an observer at the station and by another observer in the train.

2. (a). A small ball of radius r falling through a viscous liquid of viscosity η with a velocity V, derive the exact form of the relationship between the viscous force F, experienced by the ball r, η and V

(b). Given the vectors $A = i + 4j$, $B = 2i - 2j$ and find: (i) $A \cdot (B \times C)$ (ii) $(A \times B)$. (iii) show that $A \cdot (B \times C) = B \cdot (C \times A)$
What vector property is observed here?

(c) Given the vectors. $A = 2i - 4j + 2k$; $B = 3i + 6j - 3k$
Show that the two vectors $\vec{A}$ and $\vec{B}$ are parallel

SECTION B

3. (a) (i) State the law of conservation of linear momentum.

(ii) A 4kg particle moves with a velocity of A 4kg particle moves with a velocity of $\vec{l} = 4.5i + 0.5j$ m/s. determine the angular momentum relative to the origin when its position vector $\vec{l} = 3i - 2jm$.

(b) A 20kg mass moves in circle of radius 5.0m radius starting from rest. The angular momentum $L = 3t^2$ (kg m²/s) (i) what torque acts on the mass about the centre of the circle after 2s (ii) Derive an expression for the angular velocity $\omega(t)$ as a function of time

4. (a) State the parallel axis theorem.

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(b). A 20kg mass moves in circle of radius 5.0m starting from rest. The angular momentum $L = 3t^2$ (kg m^2/s). (i). what torque acts on the mass about the centre of the circle after 2s. (ii). Derive an expression for the angular velocity $\omega(t)$ as a function of time.

4. (a). State the parallel axis theorem.

(b). Four 5kg point masses occupy the corners of a square of side 1.0m. Find the moment of inertia of the system about an axis perpendicular to the square and passing through its centre.

(c). Using the parallel axis theorem, determine the moment of inertia of the system in question 4b above, at an axis perpendicular to the square and passing through any of the 5kg mass.

SECTION C

5. (a). State Pascal's principle.

(b). Suppose there is a point A, at a distance h below the surface of a liquid open to the atmosphere, show that the pressure at a point A is given by $P = P_o + \rho gh$ Where the symbols have their usual meaning.

(c). A 2N force is applied to the plane of a hypodermic needle. (i) if the diameter of the [illegible] 1.0cm and that of the needle is 0.20mm, with what force does the fluid leave the needle. (ii) What force on the plunger would be needed to push fluid into a vein, where the gauge pressure is 18mmHg. (Assume 1mmHg = 133N/m^2).

6. (a). Define the terms; *Density* and *Relative density* (Specific gravity).

(b). A density bottle was used to measure the density of glass in the form of beads and the following measurements were taken.
Mass of empty bottle = 26.5g
Mass of bottle filled partly with beads = 61.5g
Mass of bottle with beads and topped up with water. = 97.0g
Mass of bottle filled with water only. = 76.0g (Take density of water 1000kgm^{-3})
Find: (i). The volume of the water (ii) The volume of the bead
(iii) The density of the glass. State any assumption made.

(c). A light alloy consists of 70% aluminum and 30% magnesium by mass. What would you expect the density to be? (Density of aluminum = 2700kg/m^3; Density of magnesium = 1740kg/m^3)

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RIVERS STATE UNIVERSITY
FACULTY OF SCIENCE
PHY 105: GENERAL PHYSICS 1 MAIN EXAMINATION FOR YEAR 1 SCIENCE AND OTHERS

FIRST SEMESTER EXAMINATIONS

PHY 105: INTRODUCTION TO MECH & PROP OF MATTER
TIME: 2 1/2HRS

Instructions: Attempt any question from each section and any other one from any section, making total of four questions.

Some physical constants: Acceleration due to gravity $g = 10ms^{-2}$ density of pure water, $P_{water} = 1 \times 10^3 kgm$ Gravitational constants $G = 6.67 \times 10^{-11} Nm^2kg$

SECTION A

1(a) What is matter ✓

(b) With a clear diagram differentiate the various regimes of physics known to you.

(c)i Mention the 2 theories that constitute the theory of relativity

ii List 3 consequences of each.

2(a) What is a (i) Unit (ii) S.I. unit

(b) Mention the 2 fundamental quantities and their units.

(c) Convert

(i) 500km/hr to m/s

(ii) 1500 micro Farads to Farads

(iii) 36 Pico ohms to ohms

(d) Given the relation below verify that the relation is dimensionally correct where symbols carry their usual meanings.

(e)i Define Viscosity and hence by dimensional analysis obtain its unit.

ii Given the expression by dimensional analysis obtain the units of G where symbols have their usual meanings

$F = \frac{m_1 m_2}{r^2}$

SECTION B

3 (a) Distinguish between the following

(i) Density and relative density

(ii) Mass and weight

3(b) Describe briefly the principle that applies to the following observations

(i) Ice block floats in water

(ii) A heavy parcel carried by thin string tends to cut into the fresh, while the same parcel carried with thick string is comfortable to the hand.

3(c) A hydraulic press has a large piston of cross-sectional area A_1 200cm and the smaller piston has cross-sectional area A_2 = 5.0cm. If a force(F_1) of 10KN is applied to the large piston find the force (F_2) on the small piston.

4(a) Distinguish with diagrams only between lamina and turbulent flow of a liquid.

4 (b) With diagrams only but fully labeled demonstrate the following.

i. Capillary rise when a capillary tube is placed inside water.

ii. Capillary depression when capillary tube is placed inside mercury.

iii. Angle of contact between

Water and its container

Mercury and its container

4(c) Castor oil at 20° has a coefficient of viscosity $\eta = 24 Nsm^{-2}$ and a density $p = 940 kgm$ calculate the terminal velocity. V. of a steel ball bearing radius 20mm falling under gravity in the oil taking density of steel as 7800kgm.

SECTION C

5(a) Define the term Poisson's Ratio

(b) Using the stress-strain graph only show clearly the following features

i. Proportionality Region

ii. Proportionality Limit

iii. Elastic Region

iv. Elastic Limit

v. Yield Point

vi. Ultimate Tensile Strength

vii. Breaking point

(c) What is the minimum cross-section area required of a vertical steel wire from which is suspended a 250kg chandelier. Assume a safety factor of 5.0 given that the compressive strength of the steel is $500 \times 10 N/m^2$

6(a) Define the following terms

(i) Shear stress

(ii) Tensile stress

(iii) Young's modulus

(b) State 3 factors upon which moment of inertia depends.

(c) Four (4) masses occupy the corners of a square of side 20m. Find the moment of inertia of the system.

i. About an axis perpendicular to the square and passing through its centre of mass.

ii. Use the parallel axis theorem or any other method to calculate the moment of inertia of the system about an axis perpendicular to the square and passing through any one of the masses.

Believe in yourself and all that you are.
Know that there is something inside you that is greater than any obstacle.

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You don't have to be great to start, but you have to start to be great. -Zig Ziglar

My dear, I just want to remind you that you have started your journey to greatness and success is sure for you if you diligently follow the path of excellence.

Do your best and leave the rest for God, because I am sure that God, who began the good work within you, will continue his work until it is finally finished on that day when Christ Jesus comes back again. Phil.1.6 (NLT)

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