الجامعة الوطنية
National University
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
DPHYS-I: PHYSICS 1
Fall 2024

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration:	2 hours
Instructor's Name:	Jahanzeb Khan Bahadur & Ranjith Vasudevan
Exam Date:	08/01/2025
Program:	DO

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	10

Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[5 marks]**

Circle the correct choice in the following Multiple-Choice Questions.
Each question carries 1 mark.

(i) A ship sinks deeper into seawater as cargo is added. This is because:

(a) The density of the ship increases, increasing the buoyant force.

(b) The volume of water displaced decreases.

(c) The weight of the ship increases, displacing more water.

(d) The seawater density decreases, reducing the upthrust.

(ii) The restoring force in Hook's Law proportional to

(a) Extension or displacement from mean position

(b) Mass of the object

(c) Velocity of object

(d) Coefficient of friction

(iii) The commercial unit of energy used by electricity companies is

(a) Joule (J)

(b) Watt (W)

(c) Kilowatt-hour (kWh)

(d) Megajoule (MJ)

(iv) According to Archimedes' Principle, the buoyant force acting on an object is equal to:

(a) The volume of the fluid is displaced by the water.

(b) The weight of the fluid is displaced by the water.

(c) The density of the fluid multiplied by the volume of the object.

(d) The weight of the object is in the air.

(v) The term for the constant velocity reached by an object in free fall when the air resistance equals its weight is

(a) Uniform Velocity

(b) Terminal Velocity

(c) Acceleration Velocity

(d) Drag Velocity

Question 2 **[10 marks]**

(a) Describe each equation of buoyancy in your own words: (3 marks)

(i) $F_b = m_w \times g$

(ii) $F_b = F_{ga} - F_{gw}$

(iii) $F_b = D \times V \times g$

(b) A group of maritime students are determining the density of an unknown metal in the physics slab. The mass of the metal piece is 1500 g in air. When completely submerged in water, its weight is 12 N. Calculate the buoyant force acting upon the object using Archimedes' principle. (2 marks)

(c) Using Archimedes' principle, estimate the mass of water displaced by the object. (1.5 marks)

(d) Using Archimedes' principle, Calculate the object's volume by taking the density of water 1.0 g/cm^3. (1.5 marks)

(e) Determine the density of the unknown metal. (2 marks)

Question 3 **[8 marks]**

(a) The total mass of 10 liters of paint drum is 12.4 kg. This container is hung with spring. The initial length of spring is 15 cm. After hanging the drum, the length of the spring increases by 27 cm. Calculate the total weight of the paint drum in the SI unit. (1.5 marks)

(b) By using Hook's law, determine the value of the spring constant. (1.5 marks)

(c) All paint is consumed inside the engine room, and the empty drum is now hung again with the same spring, stretching the spring to a length of 19 cm. Calculate the force that stretches the spring to a length of 19 cm. (1.5 marks)

(d) By using the answer in part (a) and part (c), calculate the mass of the paint used in the engine room in the SI unit. (2 marks)

(e) If the density of the oil is 1.84 g/cm^3, calculate the volume of the paint in cm^3. (1.5 marks)

Question 4 **[8 marks]**

An oil tanker carrying 60,000 Tonne of crude oil has a mass of 160,000 Tonne and takes 3 hours to gain an average speed of 40 km/h from rest.

(a) Calculate the total weight of the oil tanker and write your answer using scientific notation. (2.5 marks)

(b) Estimate the force acting upon the ship for 3 hours to gain an average 40 km/h speed. (3.5 marks)

(c) The engine continuously exerts the same force as calculated in part (b), but the ship's speed remains constant after 3 hours. Discuss the factors that cause the boat's speed not to increase. (2 marks)

Question 5 **[9 marks]**

(a) Differentiate between kinetic energy and potential energy. (3 marks)

(b) A tugboat pulls the ship by a force of 450 MN at an angle of 53^{O} up to 0.8 km. (3 marks)
Calculate the work done by the tugboat and write your answer using scientific notation.

(c) The boat takes 1.5 hours to move the ship up to 0.8 km. Calculate the power consumed by the boat for 1.5 hours. (3 marks)

CONVERSION OF PHYSICAL QUANTITIES

Conversion of Length		**Conversion of Mass**		**Conversion of Time**	
1km	*10^{3} m*	*1 Kg*	*10^{3} g*	*1 year*	*365 days*
1m	*10^{-3} km*	*1 g*	*10^{-3} Kg*	*1 month*	*30 days*
1m	*10^{2} cm*			*1 day*	*24 hours*
1cm	*10^{-2} m*	*1 g*	*10^{3} mg*	*1 hour*	*60 minutes*
1m	*10^{3} mm*	*1 mg*	*10^{-3} g*	*1 minute*	*60 seconds*
1 mm	*10^{-3} m*				
1m	*10^{6} μm*	*1 Kg*	*10^{6} mg*	*1 second*	*10^{3} ms*
1 μm	*10^{-6} m*	*1 mg*	*10^{-6} Kg*	*1 ms*	*10^{-3} seconds*
1m	*10^{9} nm*				
1 nm	*10^{-9} m*	*1 g*	*10^{6} μg*	*1 second*	*10^{6} μs*
1m	*10^{12} pm*	*1 μg*	*10^{-6} g*	*1 μs*	*10^{-6} seconds*
1 pm	*10^{-12}m*				
1 mile	*1.60934 Km*	*1 Kg*	*10^{9} μg*	*1 second*	*10^{9} ns*
1 Km	*0.621371 miles*	*1 μg*	*10^{-9} Kg*	*1 ns*	*10^{-9} seconds*
1 nautical mile	*1.15078 miles*				
1 mile	*0.868976 nautical miles*	*1 Tonne*	*10^{3} Kg*	*1 second*	*10^{12} ps*
1 nautical mile	*1.852 Km*	*1 Kg*	*10^{-3} Tonne*	*1 ps*	*10^{-12} seconds*
1 Km	*0.5399 nautical mile*				

CONVERSION OF SPEED/VELOCITY

1mph (miles per hour) = 1.60934 km/h (kilo meter per hour)

1Km/h (kilo meter per hour) = 0.621371mph (miles per hour)

1Knot = 1.15078 mph (miles per hour)

1 mph (miles per hour) = 0.868976 Knot

1 Knot = 1.852 Km/h

1 Km/h = 0.539957 Knot

1 Km/h = 0.277778 m/s

1 m/s = 3.6 Km/h