الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
MPHYS - I: PHYSICS - 1
Fall 2025

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: 2.5 hours
Instructor's Name: RANJIT V
Exam Date: 24/12/2025
Program: ME

	40
	10

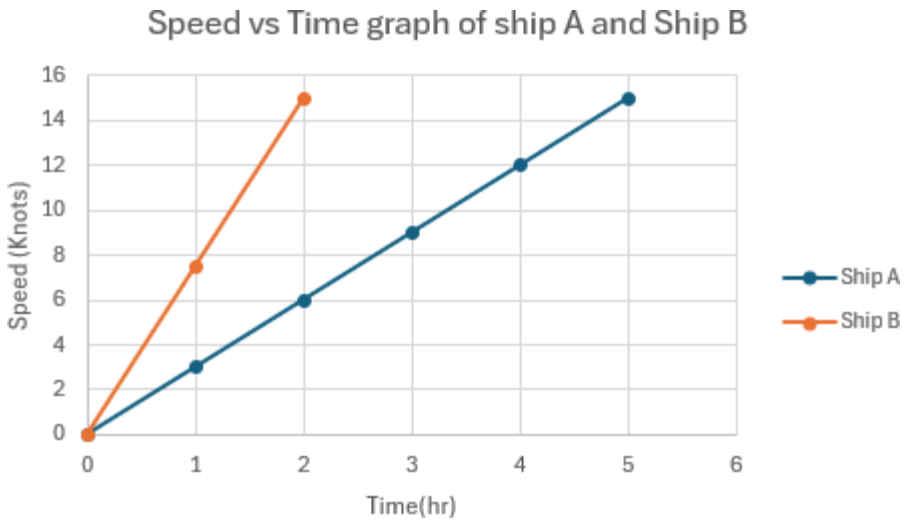
Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[5 marks]**

MCQ & Very short answer questions – Each question carries one mark.

a) Two ships (A and B) have identical final speeds as shown on their speed-time graphs. Ship A reaches the speed in 5 hours, Ship B in 2 hours. Which of the following statements is correct?



i) Ship A has greater acceleration
ii) Ship B has greater acceleration
iii) Ship A and B have same acceleration
iv) Acceleration cannot be determined from graph.

b) A spring extends from 30 cm to 45 cm when a load is applied. If the load doubles, extension becomes:

i) Still 15 cm
ii) 22.5 cm
iii) 30 cm
iv) Not enough information

c) A ship is moving at constant velocity in calm sea. Which statement is correct?

i) No forces are acting on the ship.
ii) The applied forward force equals opposing forces.
iii) Acceleration must be increasing.
iv) Weight become zero.

d) If the normal reaction force increases, then friction:

i) Decrease ii) Increases

iii) Remain Constant iv) Becomes zero

e) A body is thrown vertically upward with an initial velocity of 30 m/s. At maximum height, its acceleration is :

i) 9.8 m/s^2 ii) 0 m/s^2

iii) Depends on its mass iv) – 9.8 m/s^2

Question 2 **[12 marks]**

A cargo ship leaves Sohar Port and reaches a constant speed of 20 knots in 1 hour. It continues at this speed for the next 4 hours. After that, the speed reduces uniformly, and the ship comes to rest in 2 hours.

a) Convert the ship's velocity from knots to SI unit. (2 marks)

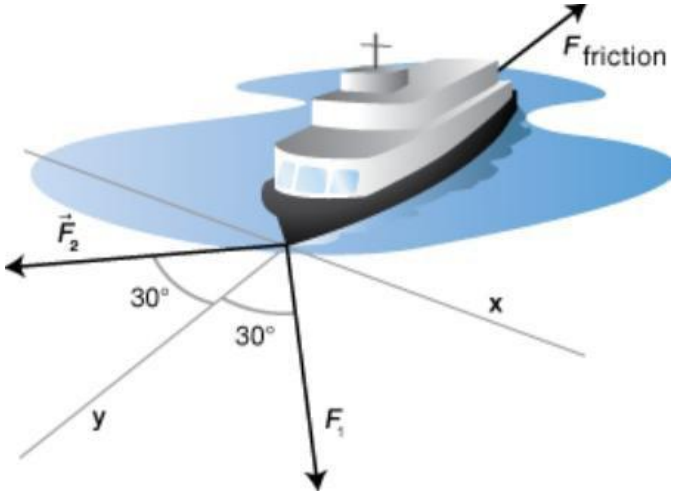
b) Calculate the initial and final acceleration in SI units. (2 marks)

c) Using equations of motion, calculate the total distance travelled by the ship during its entire journey. (4 marks)

d) Draw a speed–time graph and calculate the total distance using the graphical method. Justify whether your distance calculated in part (c) matches the distance from graphical method. (4 marks)

Question 3 **[10 marks]**

a) The figure below shows a ship being acted upon by two tugboat forces and a frictional force due to water resistance.



(ropebook, 2019)

Force F_1 = 30 kN and Force F_2 = 30 kN acts at an angle of 30° about the y axis as shown in the figure. A frictional force Fy = 15 kN acts in a direction, opposing motion.

i) Calculate the magnitude and direction of the resultant force of F_1, F_2 and F_y . (2 marks)

ii) Based on the resultant force, decide whether the ship will move straight, turn or slow down. (1 mark)

b) A coast guard boat of mass 15 tonne accelerates uniformly from rest and reaches a speed of 55 km/h in 8 minutes. After 8 minutes, even though the engines apply the same force, the boat continues at constant velocity.

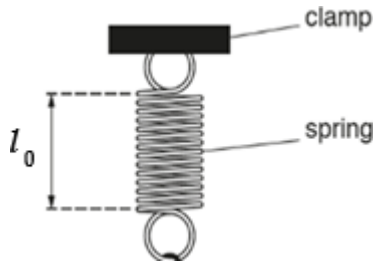
i) Calculate the weight of the boat in SI unit. (2 marks)

ii) Calculate the force produced by the engine during the first 8 min. (3 marks)

iii) Explain why the boat does not accelerate even though the force remains applied after 8 minutes. (2 marks)

Question 4 **[5 marks]**

A group of students measured the length l_0 = 2.1 cm of spring when it's not loaded as shown below.



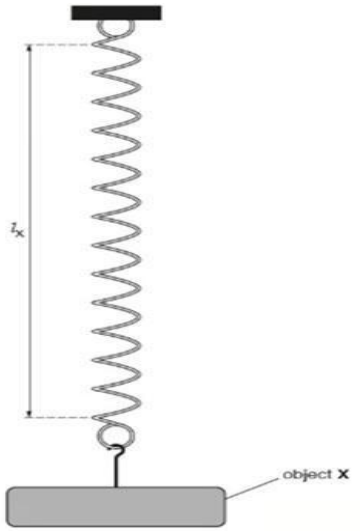
(savemyexam, 2021)

Variuos loads W are hung on the spring and the stretched length *l* of the spring is recorded in the table below.

a) Calculate the extension (e) for each load and complete the table. (2 marks)

Load W (in N)	New stretched length l (cm)	Extension e (cm)
1.0	6.3	
2.0	10.5	
3.0	14.7	
4.0	18.9	

b) The loads are removed, and another object X is loaded. The new stretched length l_x of the spring under the load is 11.4 cm.
Calculate the weight of the object X. (3 marks)



(savemyexam, 2021)

Question 5 **[8 marks]**

A tugboat pulls a ship using a force of 500 MN at an angle of 35° over 0.55 km, taking 50 minutes.

a) Explain mathematically how angle affects work done. Also calculate the work done in scientific notation. (3 marks)

b) Calculate the power consumed during the process in kW. (3 marks)

c) Analyse what happens if the tugboat pulls the ship along the same direction of motion. Hence, decide whether pulling at an angle or pulling straight is more effective. Justify your answer using ideas of force components, work done, and power consumption. (2 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 Tone	10^{3} Kg	1 second	10^{12} ps
1 nautical mile	1.852 Km	1 Kg	10^{-3} Tone	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

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	**1**	Recall, Knowldege,	**5**	All question need to be done
2	**2,5**	Apply, Create	**12**	
3	**2,3**	Apply and Analysis	**10**	
4	**2,3,4**	Apply,	**5**	
5	**2,3,**	Apply and Analysis	**8**	

Reference

"The 3:1 Pulley System." *Ropebook*, 31 July 2019, www.ropebook.com/information/pulley-systems/3-1-pulley-system/.

"Effects of Forces | Cambridge (CIE) IGCSE Physics Exam Questions & Answers 2021 [PDF]." *Save My Exams*, 2021, www.savemyexams.com/igcse/physics/cie/23/topic-questions/1-motion-forces-and-energy/1-4-effects-of-forces/alternative-to-practical-questions/. Accessed 6 Dec. 2025.