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

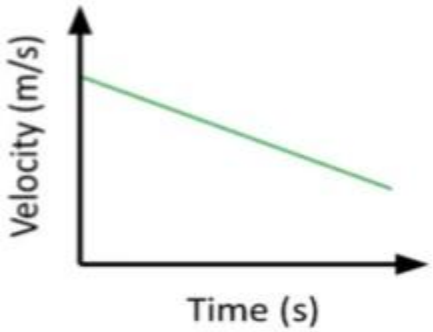
Student Information			
Name:		ID:	
Signature:			

Invigilator			
Initials:		☐ Student ID checked	
Time received:			

Question 1 **[5 marks]**

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

a) A speed–time graph shows a decreasing straight line. This graph infers that



i) The object is travelling faster

ii) The object is travelling with positive acceleration

iii) The object is experiencing zero net force

iv) The object is slowing down with constant deceleration

b) Which of the following quantities is a vector?

i) Distance ii) Speed

iii) Acceleration iv) Mass

c) If spring is stretched beyond its elastic limit, how will it behave?

i) It will obey Hooke's Law indefinitely.

ii) It will undergo plastic deformation and not return to its original shape.

iii) It will oscillate between the stretched and compressed positions.

iv) It will become more resistant to deformation.

d) A ship travels 40 km east and then 40 km west. Which statement is TRUE?

i) Distance = 0 km, Displacement = 80 km

ii) Distance = 80 km, Displacement = 0 km

iii) Distance = 40 km, Displacement = 40 km

v) Distance = 0 km, Displacement = 0 km

e) Sliding friction is generally

i) Greater than static friction

ii) Equal to rolling friction

iii) Less than static friction

iv) Zero once motion starts

Question 2 **[6 marks]**

A dock crane lifts a 40-foot container of mass 4 tonne to a height of 25 m in 2 minutes.

a) Define work and write its SI unit. (2 marks)

b) Calculate the work done by the crane in lifting the container in SI unit. (2 marks)

c) Calculate the power consumed by the crane in kilowatts. (2 marks)

Question 3 **[12 marks]**

A new marine patrol vessel is being tested at sea. At the start of the trial, the vessel begins from rest and increases its speed smoothly until it reaches 30 knots in the first 5 minutes. It then continues moving at this constant speed of 30 knots for next 5 min. After that, the vessel speeds up again and accelerates from 30 knots to 45 knots for next 5 minutes. In the final part of the test, the vessel slows down steadily and comes to a full stop by the next 10th minute.

a) Calculate the acceleration and deceleration of the vessel during its 25 minutes of journey. Express your answer in SI units. (3 marks)

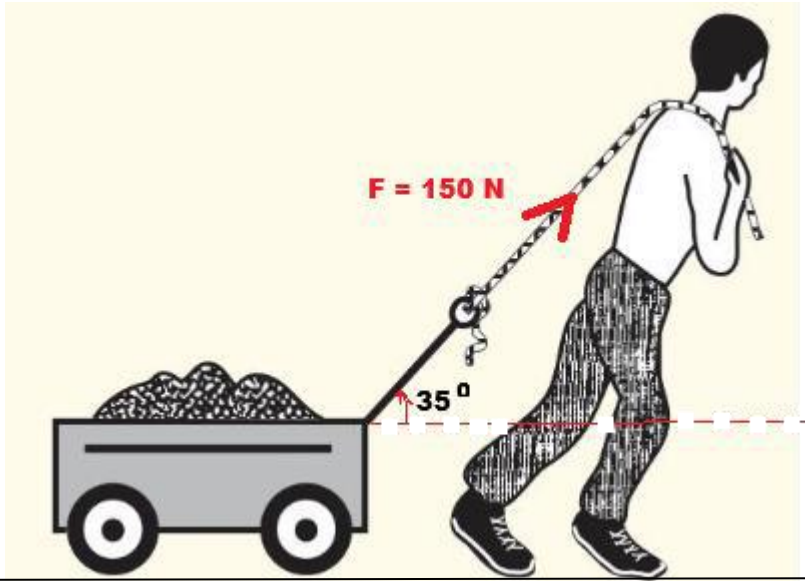
b) Draw a labelled speed–time graph showing all four stages of vessel's journey from rest to 25 min. (3 marks)

c) Calculate the total distance travelled using the graphical method. (4 marks)

d) Engineers noticed that the vessel uses more fuel when speeding up than when slowing down, even though the speed change may be similar.
With the help of the speed–time graph, explain this observation using simple terms such as acceleration, water resistance (drag), and engine power. (2 marks)

Question 4 **[10 marks]**

A marine technician is testing a small equipment cart on the ship deck. The cart has a mass of 40 kg. It is pulled with a rope applying a force of 150 N at an angle of 35° above the horizontal.



(Ceres Science, 2025)

The frictional force between the cart and the deck is 110 N, and the drag force from air resistance acting opposite to motion is 8 N

Take g = 9.8 m/s².

a) Draw a diagram of the cart showing all the forces acting on it. Split the applied force F = 150 N into horizontal (x-direction) and vertical (y-direction) components. (4 marks)

b) Calculate the resultant(total) force acting on the cart by considering all the forces acting on the cart including the friction. (4 marks)

c) Based on your resultant force from part (b), explain what will happen to the cart:
- Will it speed up (accelerate),
- Move with constant speed, or
- Slow down and stop? (2 marks)

Question 5 **[7 marks]**

In a lab experiment, a group of students are investigating the behavior of a spring under variuos loading condition. The table below shows data collected: (2 marks)

Load (N)	20	40	60	80	100
Extension (cm)	16	32	48	75	97

a) Determine the spring constant of the spring using the data.

b) Draw a force–extension graph and identify the elastic limit. (3 marks)

c) Does spring follow Hook's Law? Justify based on the graph trend. (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, Knowledge,	**5**	All question need to be done
2	**2**	Apply	**6**	
3	**2,3,5**	Apply Analysis and Create	**12**	
4	**2,3,4**	Apply, Analysis and evaluate	**10**	
5	**2, 3, 5**	Apply Analysis and Create	**7**	

Reference

Ceres Science. "Physics Worksheets and Interactive Activities." *Ceressoft.net*, 2025, physics.ceressoft.net/. Accessed 6 Dec. 2025.