

Final Exam  
**TPHYS: APPLIED PHYSICS**  
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 hours  
**Instructor's Name:** RANJIT V  
**Exam Date:** 28/12/2025  
**Program:** PE

	<b>40</b>
	<b>10</b>

Student Information	
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Signature:	<input type="text"/>
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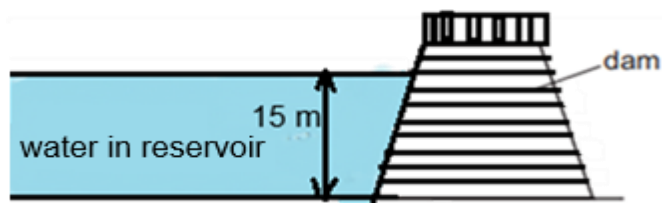
Invigilator	
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**Question 1****[6 marks]****Multiple Choice questions – Each question carries one mark.**

a) A weight 50 N falls a vertical distance of 7.0 m from rest. The change in the gravitational potential energy of the weight is

- i) decrease of 7.1J
- ii) decrease of 350 J
- iii) increase of 7.1 J
- iv) increase of 350 J

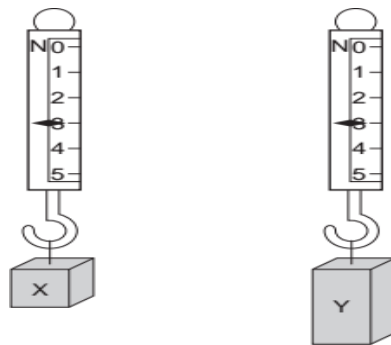
b) A dam holds water in a reservoir. The height of the water in the reservoir is 15 m.



The pressure of the water at the bottom of the dam will be

- i) 6.8 Pa
- ii) 15 00 Pa
- iii) 150 00 Pa
- iv) 150 000 Pa

c) Two blocks of metal X and Y hang from spring balances as shown in the diagram.



(savemyexam, 2025)

Choose the statement which is true.

- i) Density of X > Density of Y
- ii) Mass of Y > Mass of X
- iii) Volume of X > Volume of Y
- iv) Density of Y > Density X



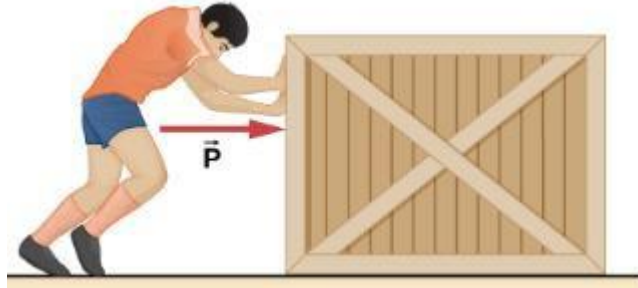
**Question 2****[8 marks]**

- a) Define mechanical work and state its SI unit.

(1 mark)

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- b) A force  $\vec{P} = 5886 \text{ N}$  is applied by a worker to push a cargo box over 800 cm along a warehouse floor. Calculate the work done on the box.



(cnxuniphysics,2025)

- c) Another worker uses a crane to lift a 600 kg container to a height of 8 m.  
i. Calculate the increase in gravitational potential energy.

(2 marks)

ii. Compare your answer with part (b) and state which scenario required more work, giving a reason based on physics principles. (2 marks)

d) If the crane motor has a rated input power of 4 kW and takes 25 s to complete the lift, evaluate whether the crane is efficient. Calculate the efficiency and justify whether it is acceptable for industrial operation. (3 marks)

**Question 3****[10 marks]**

a) Heat transfer is a very important aspect of all the processes in a process industry. Heat transfer is done using some devices such as heat exchangers, cooling towers, etc.

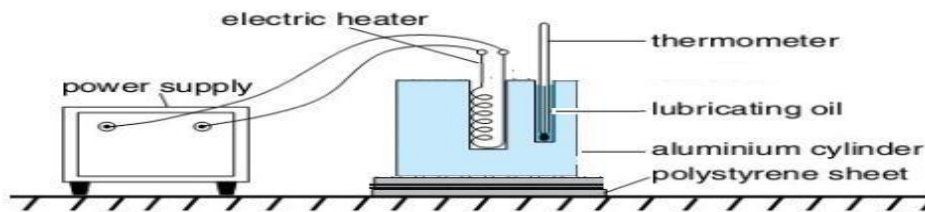
i) Discuss the difference between the terms - Thermal Energy, Temperature and Heat.

(1 mark)

ii) One of the coolest temperatures measured on Jabel Shams was 23°F. How much the same measurement will be on a Celsius and Kelvin thermometer scale.

(2 marks)

- b) For determining the specific heat capacity of metals in laboratory, an experimental setup is done as shown in the figure below:



(SPM, 2005)

The students measure the mass of the Aluminium block as 1200 g. The initial room temperature is 25 °C. The power of the heater is 700 W. The Aluminium block is heated to a final temperature of 70 °C in 1 min.

Calculate the specific heat capacity of the Aluminium block.

(2 marks)

- c) It is found that the standard specific heat capacity of Aluminum is 910.2 J/kg °C.  
i) Suggest one reason why the experimental value is lower than the standard value and identify the possible error in the setup.

(2 marks)

ii) Calculate the error percentage in the specific heat capacity of aluminum obtained from the experimental setup. (2 marks)

iii) State any one way to improve the accuracy of the specific heat capacity in the experiment. (1 mark)

**Question 4**

**[10 marks]**

- a) State the formula for hydrostatic pressure and identify each term. (1 mark)
- b) A circular inspection hatch of radius 0.45 m made of steel is placed at the bottom of a tank containing oil of relative density of 0.932 at depth of 9.2 m. Calculate the absolute pressure acting on the hatch at the bottom of the tank in SI unit. (4 marks)  
( Given 1 atm = 101.325 kPa)

c) Calculate the force acting on the hatch in kN.

(3 marks)

d) A junior engineer suggests using a thin aluminium plate to seal the hatch located near the bottom of a storage tank. Based on the above pressure distribution, evaluate whether using a thin aluminium plate is a suitable choice. In your justification, discuss material strength, safety factor, and the effect of pressure over the plate's area.

(2 marks)

**Question 5****[6 marks]**

The force vs distance graph for the movement of the loaded conveyor belt from the ship loading area to the silo in the iron pelletizing plant is shown below.



- a) Calculate the total Work done by the motor of the conveyor belt in moving from ship loader to the silo.

**(4 marks)**

- b) Calculate the power of the motor of the conveyor belt, if the total work is done in 1min 30 sec. (2 marks)

Conversion Factors

1 km = 0.62 mile

1 kg = 2.2 lbs

1 m/s = 2.2 mile/hour

1 m<sup>3</sup> = 1000 l

1 gal = 3.85 l

1 bar = 100 kPa

1 atm = 101.325 kPa

1 meter = 3.28 ft

1 ft = 12 inches

1 lb = 0.45 kg

1 ft<sup>3</sup>/s = 0.0283 m<sup>3</sup>/s

1 l = 1000 cm<sup>3</sup>

1 km = 1000 m

760 mmHg = 1 atm

1 ft = 0.3048 m

1 yard = 3 ft

1 inch = 2.54 cm = 25.4 mm

1 kg = 1000 g

1 bbl = 36.5 gal

1 psi = 6.849 kPa

lbs – pound	l – litre	ft – foot/feet	gal – gallon	bbl – barrel
atm – atmospheric pressure		psi – pound per square inch		

## MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1	Knowledge	6	
2	1,2,3	Knowledge, Apply and analyse	8	
3	1,2,3	Knowledge, Apply and analyse	10	
4	1,2,3,4	Knowledge, Apply and Evaluate	10	
5	2	Analyse and evaluate	6	

## Reference

Doubtnut. "BreadcrumbList." *Doubtnut*, 2025, [www.doubtnut.com/qna/11446946](http://www.doubtnut.com/qna/11446946). Accessed 28 Nov. 2025.

cnxuniphysics. "Friction." *Pressbooks.bccampus.ca*, vol. no, 3 Aug. 2016, [pressbooks.bccampus.ca/universityphysicsandbox/chapter/friction/](http://pressbooks.bccampus.ca/universityphysicsandbox/chapter/friction/).