Final Exam
TPHYS: APPLIED PHYSICS
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	**40**
Instructor's Name: RANJIT V	
Exam Date: 12/1/2025	**10**
Program: PE	

Student Information

Name: _____   ID: _____

Signature: _____

Invigilator

Initials: _____   ☐ Student ID checked

Time received: _____

Question 1   **[7 marks]**

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

a) Power is measured in watts.
   Choose the correct symbol for the unit of power used in industries.

   i) mW   ii) Mw   iii) mw   iv) MW

b) Liquid X has a density of 1010 kg/m^3. Liquid Y has a density of 950 kg/m^3.

   The liquids are put into tubes as shown below:
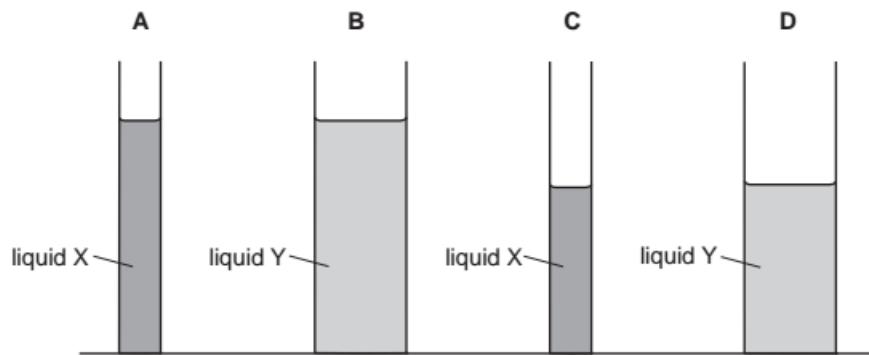
   Which tube has the greatest pressure at the bottom area?

   ....

c) A simple mercury barometer is designed to measure ....

   i)   the pressure inside the liquid.   ii)   the pressure of a gas supply.

   iii) the pressure of car tyres.   iv)   the atmospheric pressure.

d) Two objects with different masses are dropped from the same height and fall freely to the ground. Which of the following statement is true? (air friction is not considered)

   i) Both objects have the same potential energy.

   ii) Both objects will have the same kinetic energy when they reach the ground

   iii) Both objects will have the same speed when they reach the ground.

   iv) Both objects will reach the ground at the same time.

e) The diagram shows a hydroelectric power generation system.
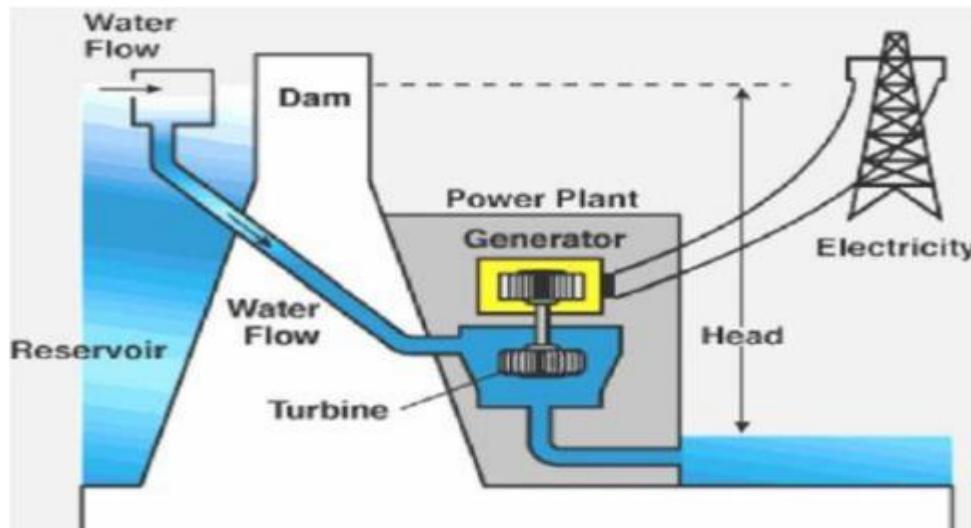
(Bartleby.com, 2021)

Choose the correct form of energy changes taking place in the above system.

i)   P.E → K.E → Electrical   ii)   K.E → P.E → Electrical

iii) Electrical → P.E → K.E   iv) K.E → Electrical → P.E

f) A force acts on an object and causes the object to move a certain distance in the same direction as the force.

Which of these represents the smallest amount of work on the object?

	Force (N)	Distance Moved (m)
A	40	4.0
B	70	3.0
C	100	2.0
D	40	6.0

g) Energy can neither be created nor destroyed, it can only change from one form to another.

Decide whether the given statement is True or False.

i)   True   ii) False

Question 2   **[9 marks]**

a) Write any two physical quantities on which the pressure due to liquid depends.   (2 marks)

....

b) Salim uses the Phet simulation software to understand the concept of fluid
   pressure at rest. The simulation shows three pressure gauges, A, B and C,
   placed at different levels in the tank, as shown below:
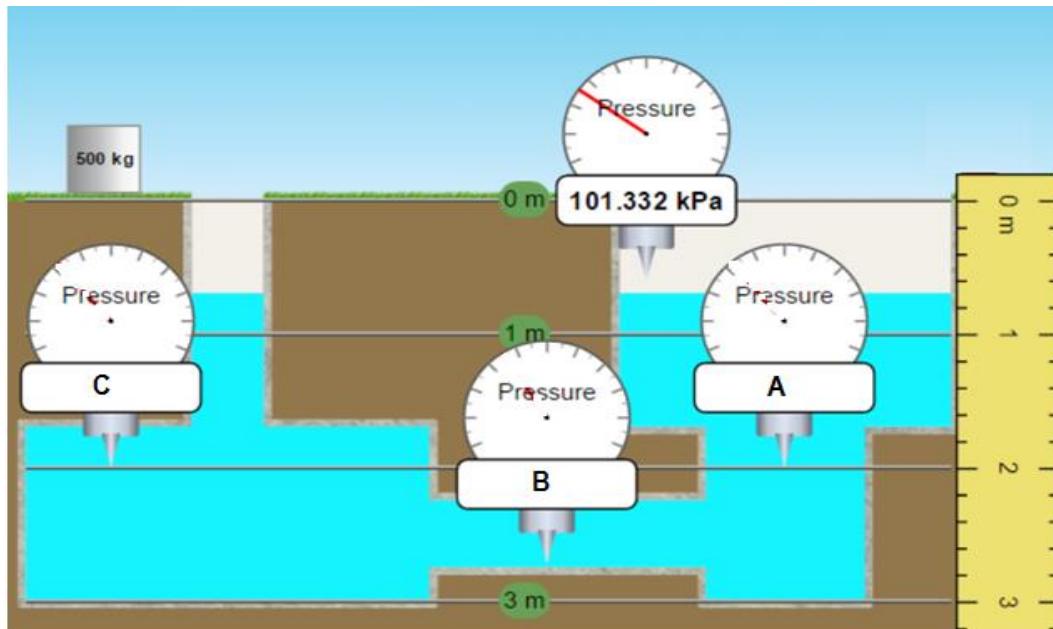
(PhET, 2024)

i) Which pressure gauge reads the maximum pressure? Justify your answer.

                                                                                                (2 marks)

....

....

ii) Comment on the readings Salim observed on the pressure gauges A and C.   (1 mark)

....

....

c) The relative density of oil in closed storage tank X is 0.9813. The tank is filled to a height of 250 cm.

  i) Calculate the gauge pressure at the bottom of the tank in SI units.   (3 marks)

X

250 cm
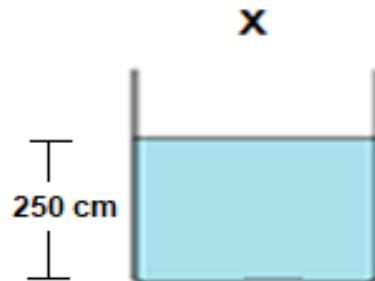
  ii) Another tank, Y, is filled to the same height as the first oil tank, X, but has double the area.

X

A

Y

2A
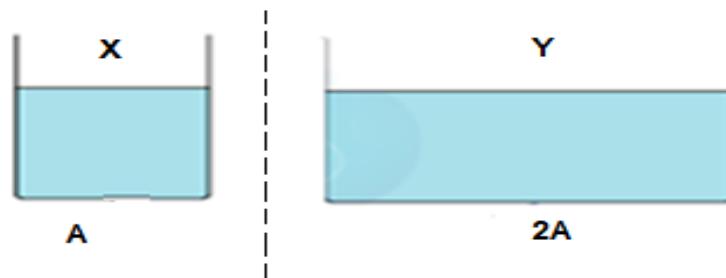
State the pressure of the oil at the bottom of tank Y.

(1 mark)

....

Question 3   **[9 marks]**

During the installation process in Sohar Refinery Area, a tower crane raises a cylindrical steel column, 8 tonnes in mass, to a vertical height of 10 m in 30 s. The force of lifting (F) with height (x) is plotted and shown below.
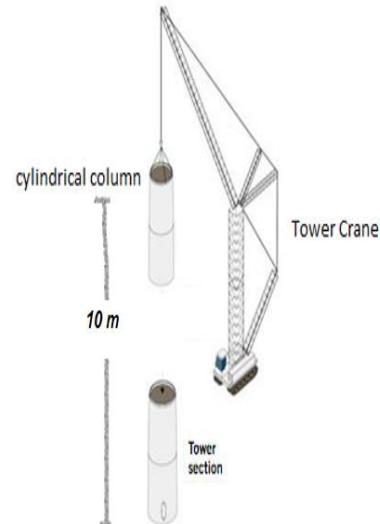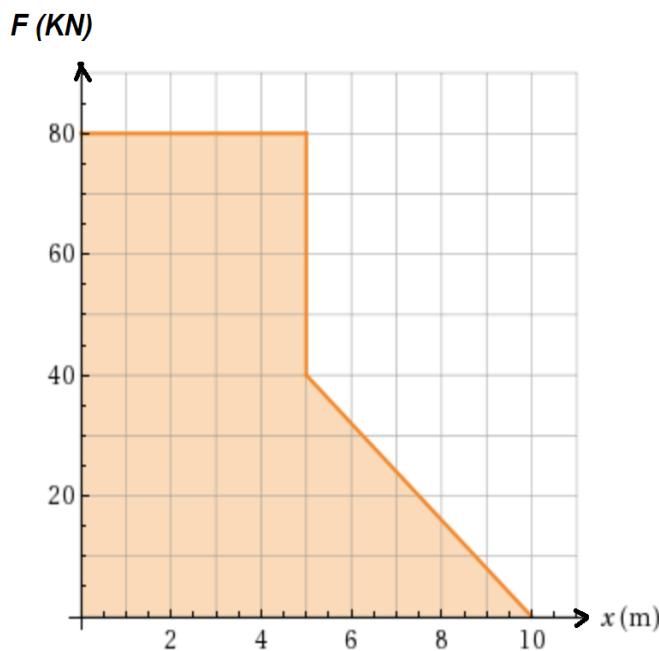
(Lunawat, 2020)

a) Calculate the work needed to lift the cylindrical steel column in the SI unit using the above graph.

                                                                   (4 marks)

(Given 1 tonne = 1000 kg)

b) State the increase in potential energy of the steel column when lifted to a height of

10 m.   (1 mark)

....

c) The crane's motor has an efficiency of 58 %. Calculate how much input electrical

energy the crane consumes to lift the load.   (2 marks)

d) Calculate the output power of the crane in kW unit.

(2 marks)

Question 4   **[8 marks]**

a) Define the term "specific heat capacity". State its SI unit.   (2 marks)

....

....

....

....

b) Give a suitable reason for using water as a coolant in high-temperature operating
   machines or systems.   (1 mark)

....

....

....

....

c) Quenching makes metals hard by heating them to a very high temperature and then
    cooling them suddenly. To create a machinery part, a 1500 g piece of iron is heated
    to an initial temperature of 525° C. It is then directly put into 3500 g of water at
    25.0° C.
    Calculate the final temperature of the water and the iron piece when they reach
    thermal equilibrium.

    (Given c_{water} = 4.2 J/(g °C) and c_{iron} = 0.450 J/g°C)   (5 marks)

Question 5   **[7 marks]**

Figure 1 and Figure 2 below show a very simple pressure-measuring gauge.
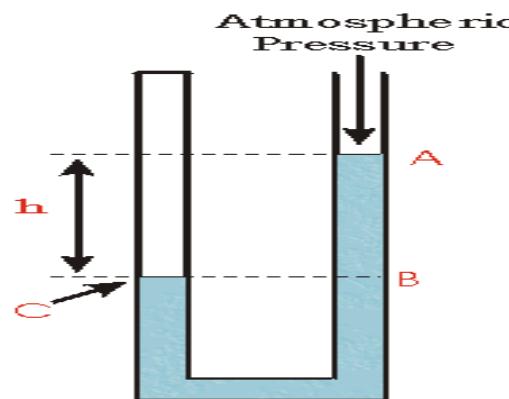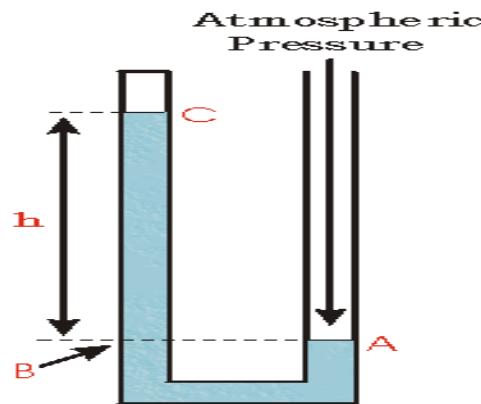

Fig 1   Fig 2

(Harrison, 2002)

a) Identify the pressure measuring gauge and name it.   (1 mark)

....

b) In which figure is the gauge pressure negative? Justify your answer.   (2 marks)

....

....

....

c) Sarah is testing a vertical pipe system installed in a factory. The pipe runs vertically

for 40 feet, and she uses couplings rated for a maximum pressure of 20 psi. The pipe

is filled with oil with a relative density of 0.975.

Can the couplings at the base handle the pressure from the oil?   (4 marks)

Conversion Factors

1 km = 0.62 mile	1 meter = 3.28 ft	1 ft = 0.3048 m
1 kg = 2.2 lbs	1 ft = 12 inches	1 yard = 3 ft
1 m/s = 2.2 mile/hour	1 lb = 0.45 kg	1 inch = 2.54 cm = 25.4 mm
$1 \text{ m}^3 = 1000 \, l$	$1 \text{ ft}^3/\text{s} = 0.0283 \text{ m}^3/\text{s}$	1 kg = 1000 g
1 gal = 3.85 l	$1 \, l = 1000 \text{ cm}^3$	1 bbl = 36.5 gal
1 bar = 100 kPa	1 km = 1000 m	1 psi = 6.849 kPa
1 atm = 101.325 kPa	760 mmHg = 1 atm	

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	**7**	
2	**1,2,3**	Knowledge, Apply and analyse	**9**	
3	**3**	Apply	**9**	
4	**1,2,3**	Knowledge, Apply and Analyse	**8**	
5	**3, 4**	Analyse and evaluate	**7**	

Reference

Harrison, D. (2002). *Manometers*. [online] faraday.physics.utoronto.ca. Available at: https://faraday.physics.utoronto.ca/PVB/Harrison/Manometer/Manometer.html.

Lunawat, P. (2020). *What are tower cranes and how do they work?* [online] Science ABC. Available at: https://www.scienceabc.com/innovation/how-do-tower-cranes-work.html