

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

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	10

Student Information	
Name:	<input type="text"/>
Signature:	<input type="text"/>
ID:	<input type="text"/>

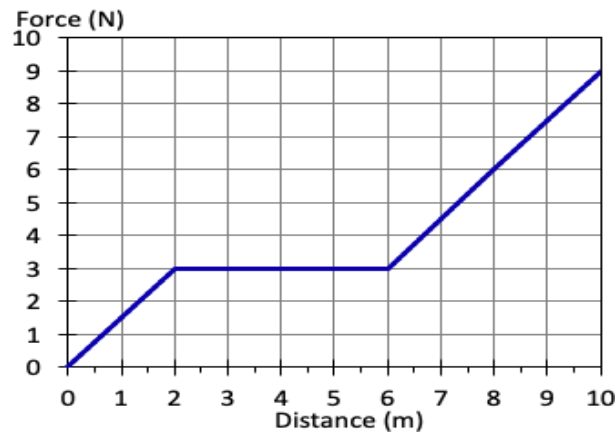
Invigilator	
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Question 1

[6 marks]

Multiple Choice Questions – Each question carries one mark.

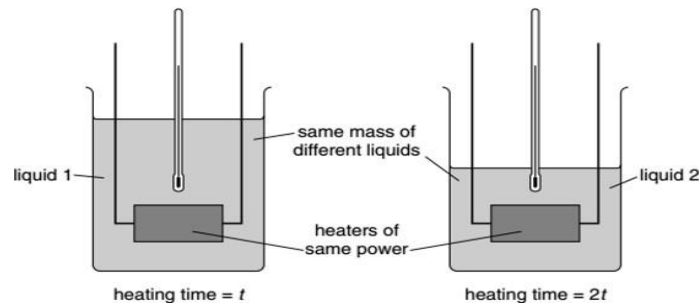
- a) A box is being pushed along a frictionless surface according to the following force vs. distance graph.



(Studyskills.com,2025)

The total work done when pushing the box is

- i) 39 J ii) 42 J iii) 52 J iv) 36 J
- b) Equal masses of two different liquids are put into two identical beakers. They are heated from 20°C to 30°C by heaters having same power. Liquid 2 takes twice as long as to heat as Liquid 1.

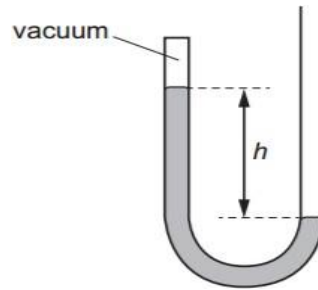


(Save My Exams, 2025)

Which of the statements is correct?

- i) Both liquids receive the same amount of thermal energy.
 ii) Liquid 1 receives more thermal energy than liquid 2.
 iii) The specific heat capacity of liquid 1 is equal to liquid 2.
 iv) The specific heat capacity of liquid 1 is lesser than liquid 2.

- c) The diagram shows an open-ended manometer containing mercury which is closed at one end.



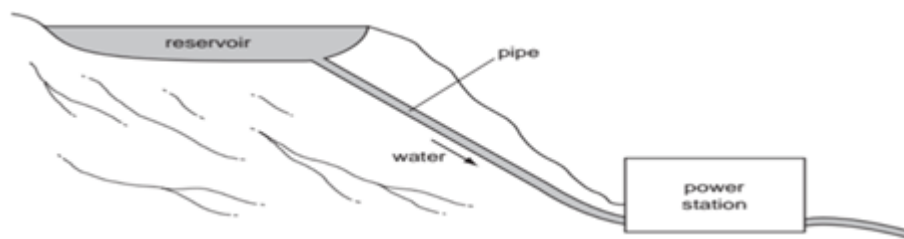
(Save My Exams, 2025)

When the mercury is replaced with a liquid of lesser density, what would be the changes in the level h ?

- i) more ii) less iii) equal iv) Can't say
- d) "Energy cannot be created nor destroyed, it can be changed from one form to another during work." The given statement is
- i) False ii) Always False iii) True sometimes iv) Always True
- e) Exactly 1 kg sample of ethyl alcohol is stored in a laboratory. In a different laboratory, in the same town, there is another 1kg sample of benzene stored. Which quantity must these two samples always have in common? Choose the correct answer.

- i) Density ii) Weight iii) Temperature iv) Volume

- f) The diagram shows a hydroelectric power station system.



(Hadis, 2025)

Which of the following shows the correct energy change happening in this system.

- i) Kinetic energy to Heat energy.
 ii) Electrical energy to Kinetic energy.
 iii) Gravitational Potential Energy to Electrical energy.
 iv) Kinetic energy to Electrical energy.

Question 2**[11 marks]**

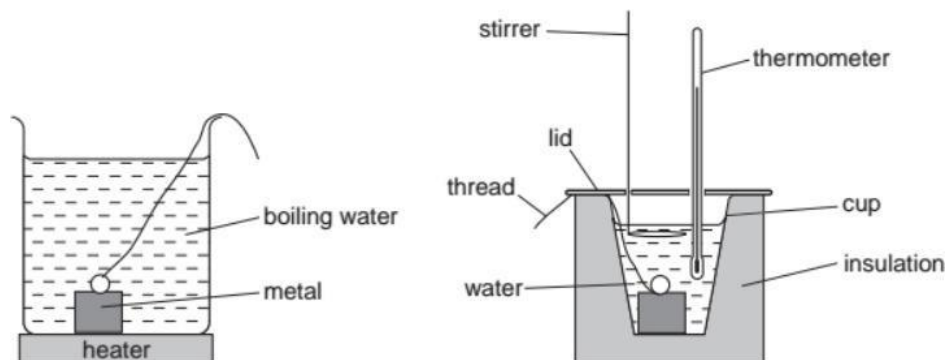
a) State what is meant by specific heat capacity. Write its SI units.

(2 marks)

b) Water has a very high specific heat capacity. ($c_{\text{water}} = 4200 \text{ J/kg K}$). List any one advantage and disadvantage of this property of water.

(2 marks)

c) Salim and Muna is conducting an experiment to determine the specific heat capacity of a solid metal block. The experimental setup is illustrated in the figure given below:



(kyanaplex.com, 2019)

The metal block is heated in boiling water until it reaches the same temperature as the boiling water. The metal block has a mass of 500 g. Once fully heated, it is quickly transferred into a calorimeter containing 250 ml of water. Before placing

the metal in the calorimeter, the temperature of the water is 23 °C. After the hot metal is added, the water warms up and reaches a final steady temperature of 27.9 °C.

- i) Calculate the thermal energy gained by the water in the cup. State the equation that Salim and Muna used. (2 marks)
(Given $c_{\text{water}} = 4200 \text{ J/kg}^{\circ}\text{C}$)

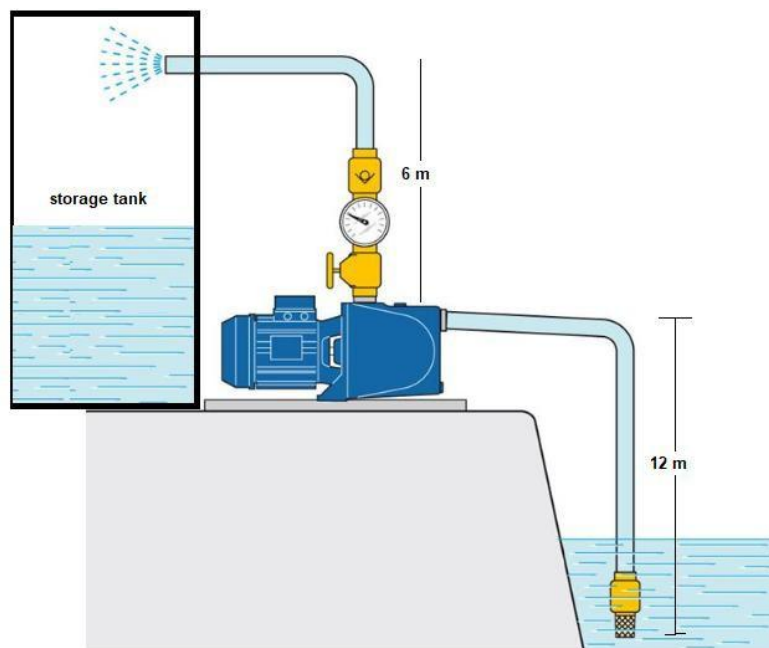
- ii) Determine the specific heat capacity of the metal block. (3 marks)

- iii) List any experimental error which could be possible which can affect the accuracy of the specific heat capacity of the metal block. Suggest any one way to avoid this error. (2 marks)

Question 3**[10 marks]**

A jet pump system is used for lifting fluid to heights using centrifugal pumps is shown in the figure given below. A jet pumps used to lift water from a well 12 m deep. The pump further raises the water to height of 6 m where the inlet valve is connected to the tank. The water is pumped at a rate of $10 \text{ ft}^3/\text{min}$ and gets collected in storage tank of 110 m^3 capacity in 6 hours.

(Density of water is 1000 kg/m^3)



(Valco-Srl, 2017)

- a) Determine the useful work done by the pump in filling the tank.

(2 marks)

b) Calculate the output power of the jet pump in SI units. (2 marks)

c) The motor operating this pump consumes 1.5 kW of electrical power. (2 marks)
i) Calculate the efficiency of the pump.

ii) Suggest one mechanical and one electrical reason why efficiency may not be 100%. (2 marks)

- d) A new pump is proposed with a claimed efficiency of **78%**, costing significantly more. Based on the calculated efficiency in part (d), discuss whether upgrading is justified. (2 marks)

Question 4**[9 marks]**

- a) Differentiate between gauge pressure and absolute pressure. Give any two differences. (2 marks)

- b) A storage tank contains hydraulic oil of relative density 0.85 and is filled to a height of 5 m. Calculate the gauge pressure at the bottom of the tank. (2 marks)

c) If the atmospheric pressure is 101.325 kPa, determine the absolute pressure at the bottom of the tank. Why absolute pressure is preferred to be used instead of gauge pressure in engineering solutions. (3 marks)

d) Based on your results, evaluate whether a pressure sensor with a maximum safe limit of 160 kPa is suitable for this tank. Justify your answer with reasoning. (2 marks)

Question 5**[4 marks]**

a) A student is comparing two samples of the same metal. Sample A is heated to 95°F and Sample B is heated to 45°C.

Decide which sample has higher temperature – Sample A or Sample B using suitable calculation. (2 marks)

b) Why does temperature alone not tell us how much heat energy an object contains?

Explain with an example. (2 marks)

Conversion Table

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 m ³ = 1000 l	1 ft ³ /s = 0.0283 m ³ /s	1 kg = 1000 g
1 gal = 3.85 l	1 l = 1000 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	

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

MLO and Bloom’s Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1,2,3	Knowledge, Application	6	
2	1, 2, 3	Apply and analyse	11	
3	2, 3	Apply & Analyse	10	
4	1,2,4	Knowledge, Apply and Evaluate	9	
5	2,3	Apply & Analyse	4	

Reference

Save My Exams. (2025). *Pressure | Cambridge (CIE) IGCSE Physics Exam Questions 2021*. [online] Available at: <https://www.savemyexams.com/igcse/physics/cie/23/topic-questions/1-motion-forces-and-energy/1-9-pressure/multiple-choice>

Hadis. (2021, September 9). *How electricity is generated in a hydroelectric power station*. IELTS Essay Bank. <https://www.ieltsessaybank.com/how-electricity-is-generated-in-a-hydroelectric-power-station/>

“Describe an Experiment to Determine the Specific Heat Capacity by the Method of Mixtures.” *KenyaPlex.com*, 2019, www.kenyaplex.com/questions/52391-describe-an-experiment-to-determine-the-specific-heat-capacity-by-the-method-of-mixtures.aspx. Accessed 6 Dec. 2025.