**Name…………………………………………………… Class Register…………..………**

**Candidate’s Signature…………**

**PHYSICS Date………………………..……**

**Theory**

**Paper 1**

*Time: 2 hours*

**OPENER EXAMINATIONS TERM 1 2021/2022**

**PAVEMENT NATIONAL EXAMINATION DEPARTMENT**

FORM FOUR

**Instructions to Candidates**

1. *Write your name and class register number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *This paper consists of* ***TWO*** *sections:* ***A*** *and* ***B****.*
4. *Answer* ***ALL*** *the questions in sections* ***A*** *and* ***B*** *in the spaces provided.*
5. *ALL working* ***MUST*** *be clearly shown.*
6. *Mathematical tables and non-programmable silent electronic calculators may be used.*
7. ***This paper consists of 10 printed pages****.*

**For Examiner’s Use Only**

|  |  |  |  |
| --- | --- | --- | --- |
| **Section** | **Question** | **Maximum**  **Score** | **Candidate’s**  **Score** |
| **A** | 1 – 12 | 25 |  |
|  | 13 | 10 |  |
| 14 | 11 |  |
| 15 | 12 |  |
| 16 | 14 |  |
| 17 | 8 |  |
| **Total Score** | | **80** |  |

**SECTION A: (25 Marks)**

***Answer all the questions in this section in the spaces provide***

1. State the reading on the Vernier caliper shown in fig. 1 below. [1]

9

87

Fig 1.

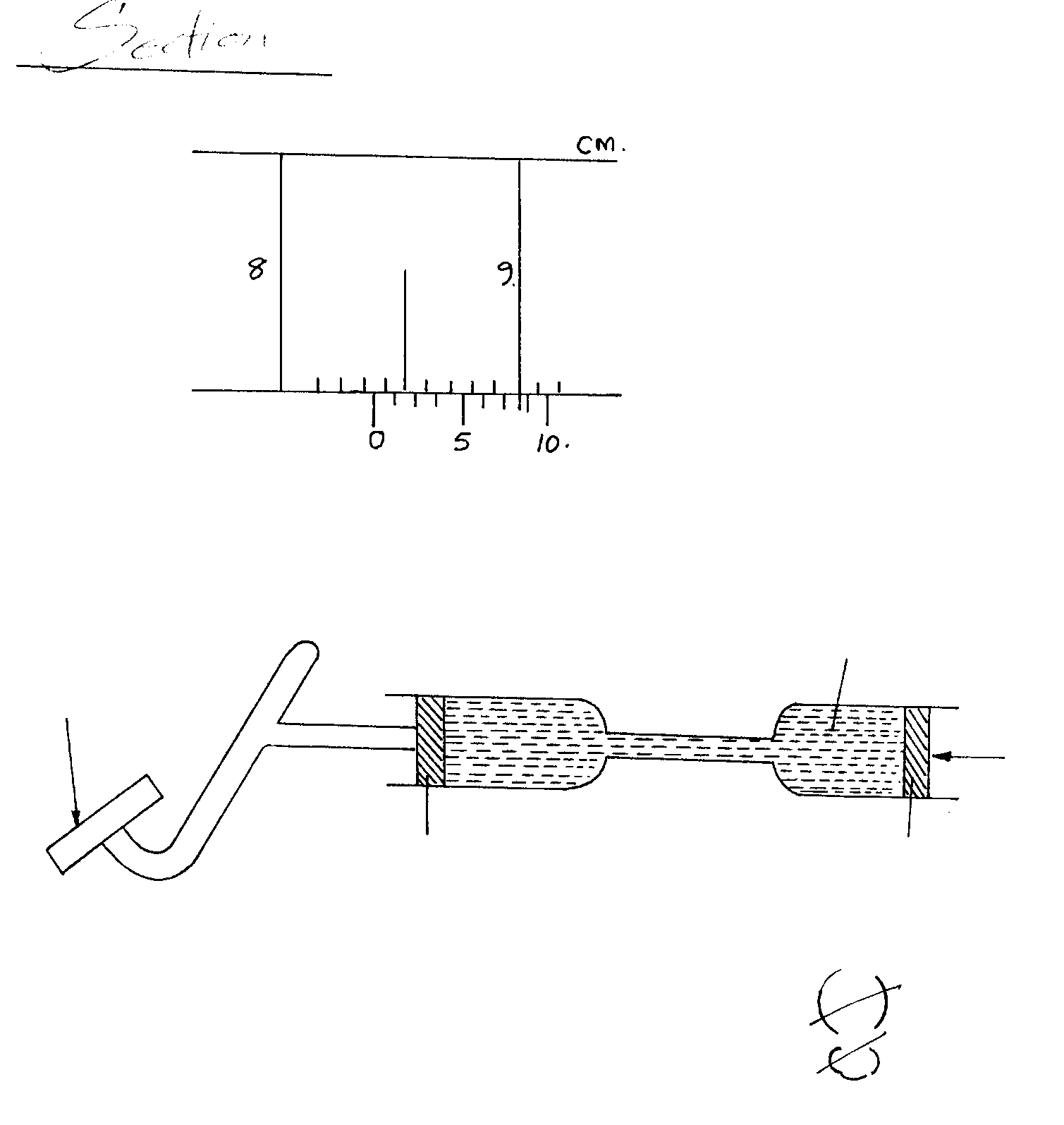
..................................................................................................................................................................................

1. A girl stands inside a lift on the second floor of an 18 storey building. If the lift is ascending upwards at an acceleration of 3ms-2 and she weighs 60kg, determine the reaction of the lift at the girl’s feet. [3]

.................................................................................................................................................................................................................................................................................................................................................................... ....................................................................................................................................................................................................................................................................................................................................................................

1. Figure 2 below represents a car hydraulic braking system.

Fluid



Force applied to brake pads

Slave piston

Master piston

Foot pedal

Fig. 2

Use the information given in the diagram above to answer questions 3(a) and 3(b).

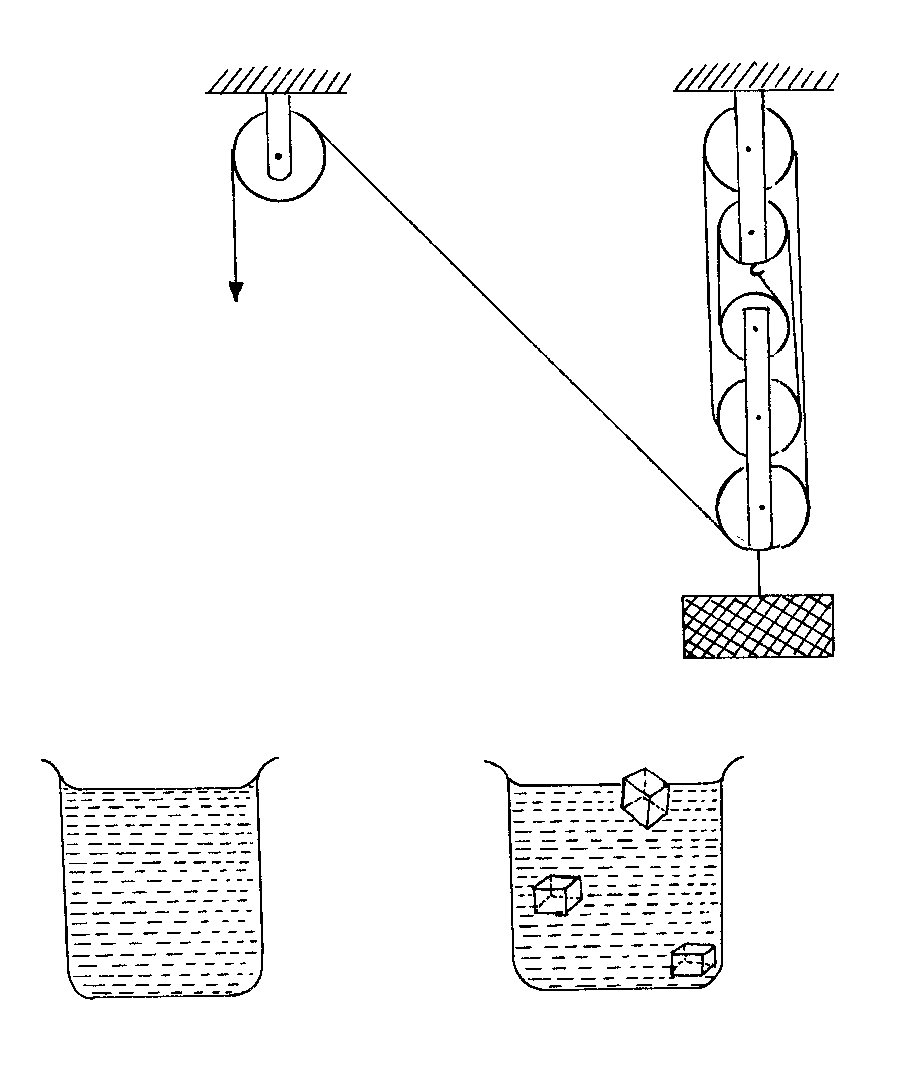
a) State one property the fluid should have. [1]

.............................................................................................................................................................................

b) Explain briefly how the system operates. [3]

.......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. Figure 3 below shows a machine being used to raise a load. Use the information given in the figure to answer questions 4(a) and 4(b) below



Effort

Load

Fig 3

a) Determine the velocity ratio (V.R) of the machine. [1]

......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

b) If a load of 800N is raised by applying an effort of 272N, determine the efficiency of the machine. [3]

......................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. What happens to the motion of smoke particles in the smoke cell experiment when the setup is moved from an environment at 270c to an environment at 47oC? [1]

....................................................................................................................................................................................................................................................................................................................................................................

1. State Charles’s Law. [1]

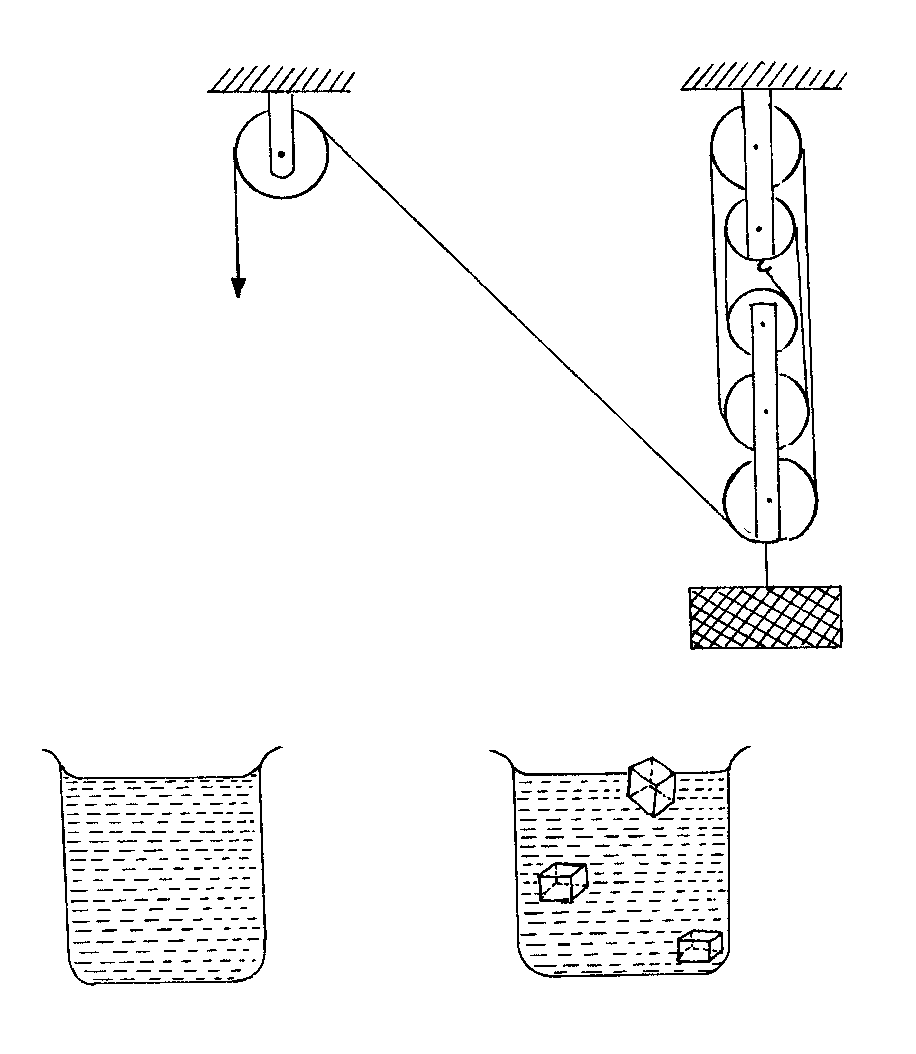
....................................................................................................................................................................................................................................................................................................................................................................

1. A piece of iron is heated. Explain what happens to its density. [2]

.................................................................................................................................................................................................................................................................................................................................................................... ....................................................................................................................................................................................................................................................................................................................................................................

1. Figure 4 below shows two identical beakers A and B. Beaker A contains water at OoC while B contains water and pieces of ice at OoC. Both contents have the same mass.

B



A

Fig. 4

Two identical metal blocks are removed from the same hot furnace and dropped into each of the beakers. Identify which of the two beakers would experience more evaporation and give a reason for your answer. [2]

....................................................................................................................................................................................................................................................................................................................................................................

..................................................................................................................................................................................

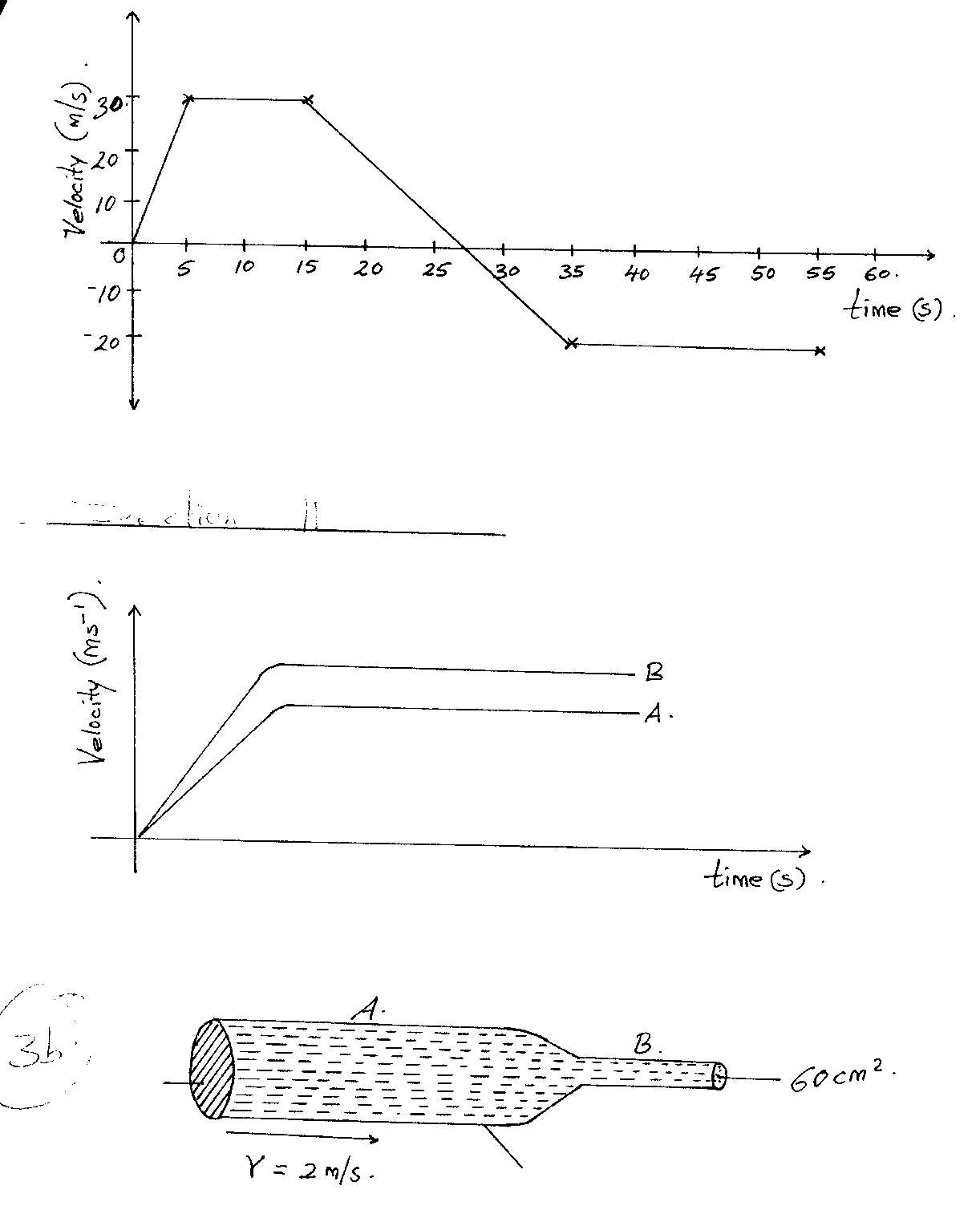
1. A force of 7.5N stretches a certain spring by 5.0cm. How much work is done in stretching this spring by 8.0 cm? [3]

.................................................................................................................................................................................................................................................................................................................................................................... ....................................................................................................................................................................................................................................................................................................................................................................

1. State the Pascal’s principle of pressure transmission in fluid. [1]

....................................................................................................................................................................................................................................................................................................................................................................

1. Figure 5 below shows a velocity time graph for a car in motion. If the mass of the car is 920kg, determine the maximum kinetic energy acquired for part of the journey shown [2]



time (s)

Velocity (m/s)

Fig. 5

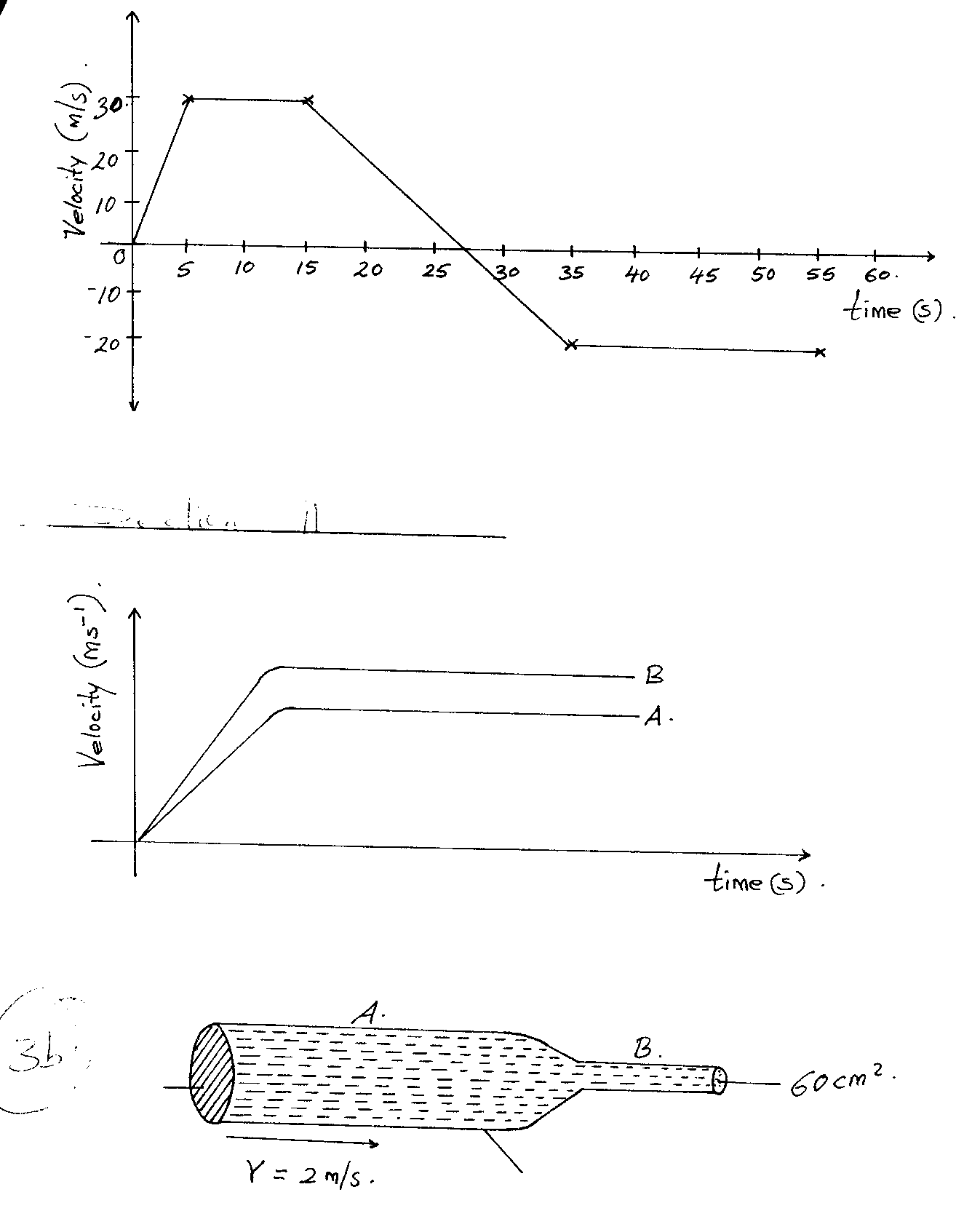
1. A bullet is fired horizontally at a target, neglecting air resistance, give a reason why the horizontal acceleration of the bullet is zero. [1]

....................................................................................................................................................................................................................................................................................................................................................................

**SECTION II ( 55 marks)**

1. a) Figure 6 above shows the velocity time graph of two identical spheres released from the surfaces of two fluids A and B

Velocity (ms-1)



A

B

time(s)

Fig. 6

1. State with reason, the fluid with a higher viscosity. [2]

................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. Mark on the diagram the terminal velocity on the sphere in each fluid. [1]

b) Water flows through a horizontal pipe of varying cross-section area as shown in figure 7 below.

A

B

100cm2

60cm2

v = 2m/s

Pipe

Fig. 7

The velocity of water in pipe A is 2m/s

1. Determine the velocity of water in pipe B. [3]

................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. State two assumptions taken in Bernoulli’s fluid flow. [2]

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. Explain why a partially inflated balloon released at sea level would become fully inflated at a higher altitude. [2]

.............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

1. (a) State Boyle’s Law. [1]

................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

(b) The table below shows the results from Boyle’s law experiment.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pressure (atmospheres) | 1.0 | 1.3 | 1.5 | 1.8 | 2.3 | 2.6 | 3.2 | 3.7 |
| Length of air column , L(mm) | 41.0 | 30.0 | 27.5 | 22.0 | 18.0 | 16.0 | 12.5 | 11.0 |
| I/L x 10-2(mm)-1 |  |  |  |  |  |  |  |  |

1. Complete the table by filling in the values for the row I/L x 10-2(mm)-1 [4]
2. Plot a graph of pressure against I /L [5]
3. Estimate the pressure of the air when I/L is zero. [1]
4. (a) Define the terms

(i) Inelastic collisions [1]

................................................................................................................................................................................................................................................................................................................

(ii) Momentum [1]

................................................................................................................................................................................................................................................................................................................

(b) A bullet of mass 20g moving with a velocity of 1000m/s hits stationery antelope of mass 12kg. The bullet imbeds and the two move in one direction. Calculate its final velocity [2]

....................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................

(c) Block of mass 200g rests on a rough horizontal table. A force of 0.6N pulls the block so that it moves with a constant acceleration of 1m/s2 calculate

(i) The time it takes to travel a distance of 200m [2]

................................................................................................................................................................................................................................................................................................................ ........................................................................................................................................................

(ii) The frictional force between the block and the table [2]

................................................................................................................................................................................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................

(iii) The coefficient of kinetic friction between the two forces [2]

................................................................................................................................................................................................................................................................................................................ ........................................................................................................................................................

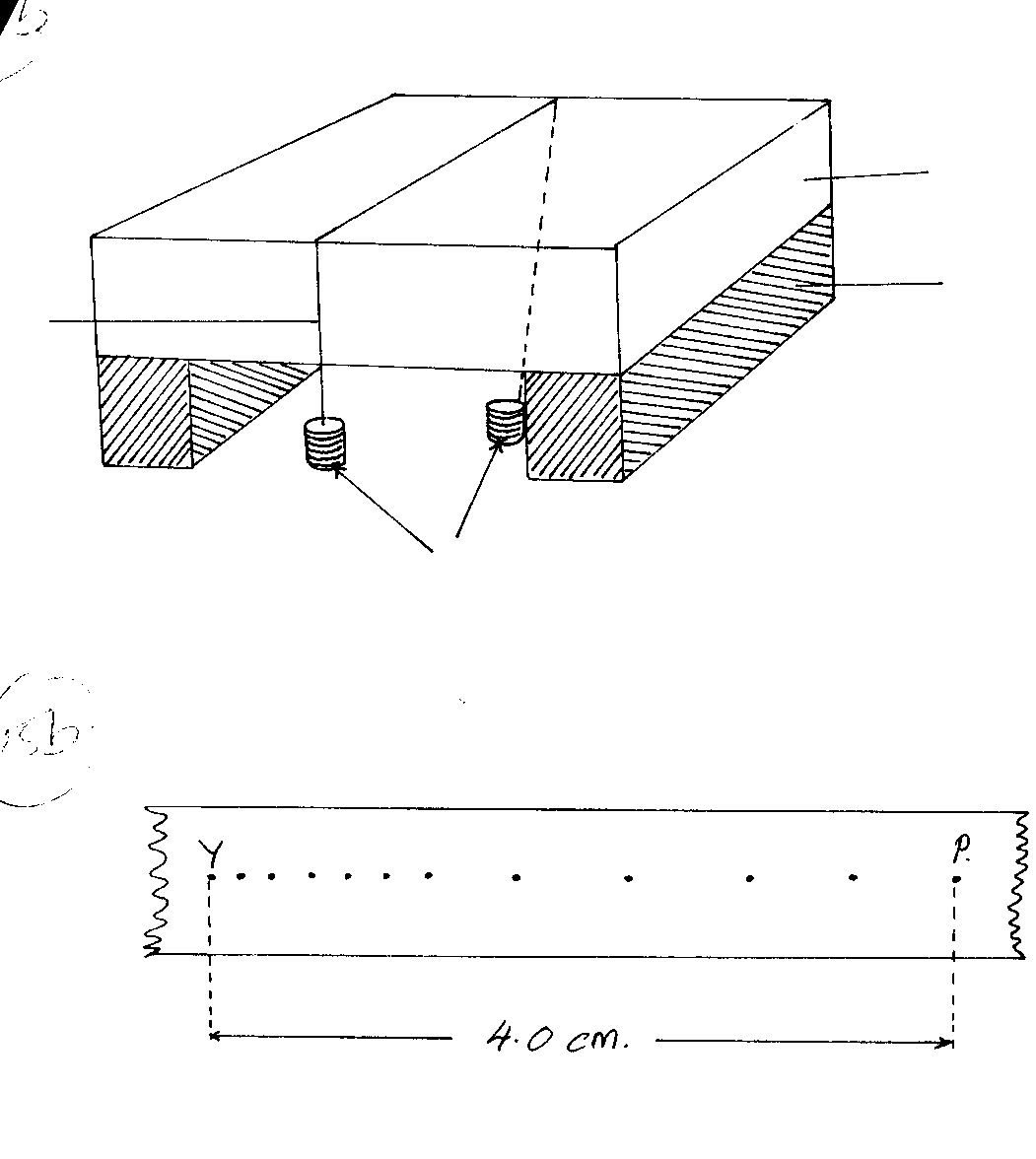
1. A part from the normal reaction and frictional force, name any other force [2]

........................................................................................................................................................

1. (a) Define the term latent heat [1]

..........................................................................................................................................................................................................................................................................................................................................

1. Figure 8 below shows a block of ice with two heavy weights hanging such that the copper wire / string connecting them passes over the block of ice.



Copper wire

weights

Wooden support

Ice block

Fig. 8

1. It is observed that the wire gradually cuts its way through the ice block, but leaves it as one piece. Explain [5]

........................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................

1. What change would be observed if the copper wire used in the experiment was replaced by a cotton thread? Explain your answer. [2]

........................................................................................................................................................ ........................................................................................................................................................ ........................................................................................................................................................

1. 3kg hot water was added to 9kg of water at 100C and the resulting temperature was 200C. Ignoring heat gained by the container, determine the initial temperature of the hot water. (Specific heat capacity of water = 4200J/KgK). [3]

............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... ..........................................................................................................................................................................................................................................................................................................................................

1. What is the operating resistance of an electric heater rated 90W, 240V? [3]

............................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... .....................................................................................................................................................................

1. a) (i) State the principle of moments. [1]

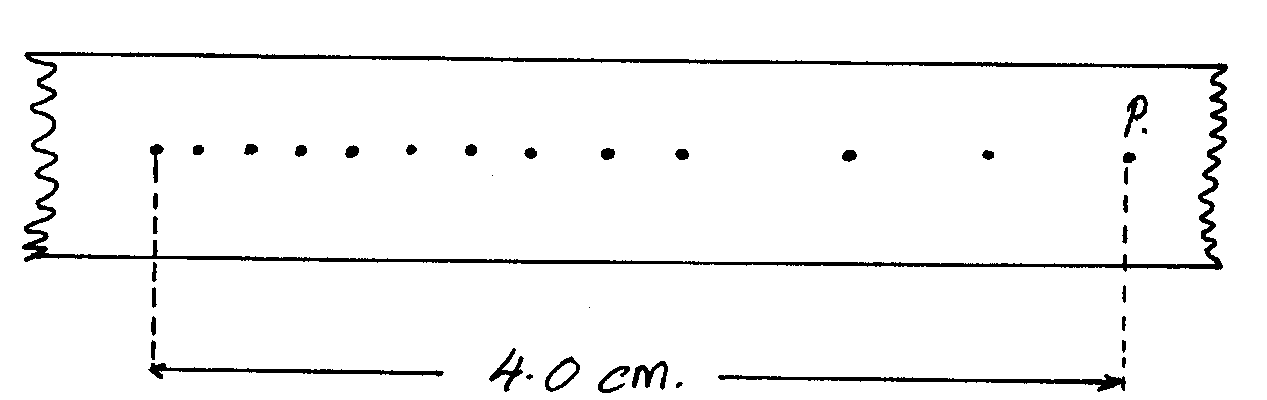
................................................................................................................................................................................................................................................................................................................

1. A uniform metre rule has a mass of 300g and is pivoted freely at the 0 cm mark. Determine the force which should be applied vertically upwards at the 55cm mark to maintain the ruler horizontally. [3]

................................................................................................................................................................................................................................................................................................................

................................................................................................................................................................................................................................................................................................................

1. Figure 9 below shows a piece of tape pulled through a ticker – timer by a trolley down an inclined plane. The frequency of the ticker-timer is 100Hz.



Y

4.0cm

P

Fig. 9

(i) Find the time between two dots. [1]

................................................................................................................................................................................................................................................................................................................

(ii) Determine the average velocity of the trolley between Y and P. [3]

................................................................................................................................................................................................................................................................................................................ ................................................................................................................................................................................................................................................................................................................