

**SECTION A (25 MARKS)**

Answer *all* the questions in this section in the spaces provided.

1. **Figure 1** shows the vernier scale of a vernier calliper.



**Figure 1**

On the figure, include the main scale so that the vernier calliper shows a reading of 3.15cm.

(2 marks)

2. Explain why weight of an object is a vector quantity.

(1 mark)

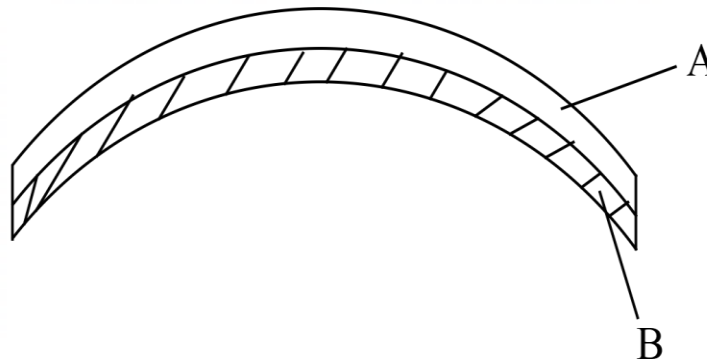
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3. **Figure 2** shows the shape of a bimetallic strip made of metals **A** and **B** when heated.



**Figure 2**

State the reason why the strip appears as shown.

(1 mark)

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4. It is observed that in order to balance a sea-saw, the heavier child sits closer to the pivot. State the reason for this observation. (2 marks)

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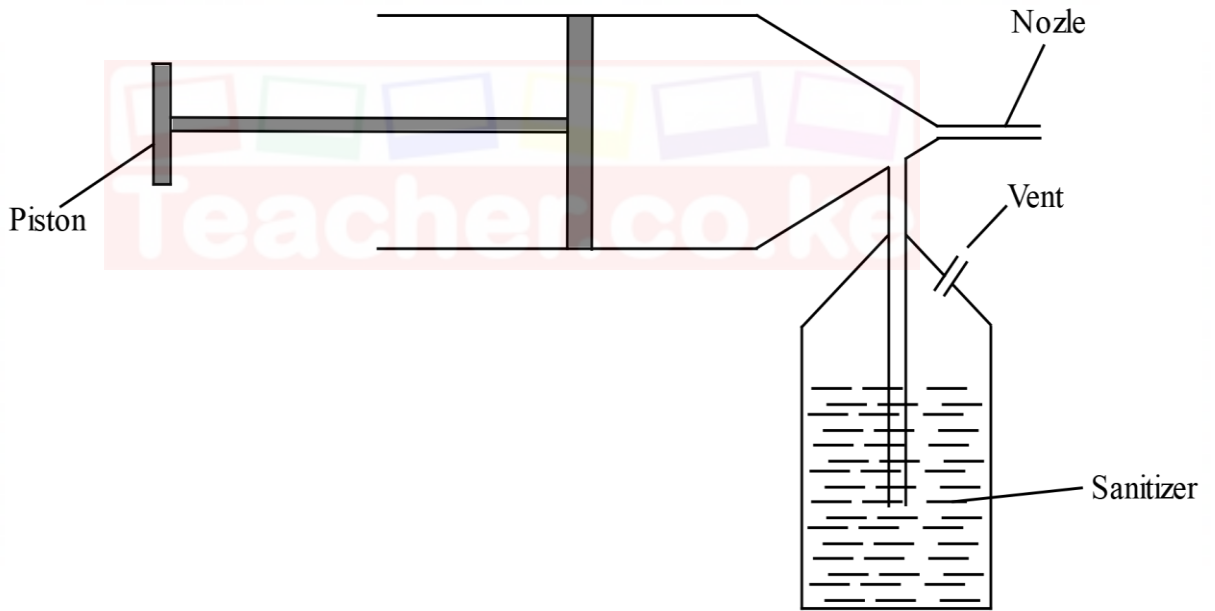
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5. Explain **one** way in which a person maintains stability when carrying a bucket of water in one hand. (1 mark)

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6. **Figure 3** shows a simple hand sanitizer dispenser.



**Figure 3**

Explain how it works. (3 marks)

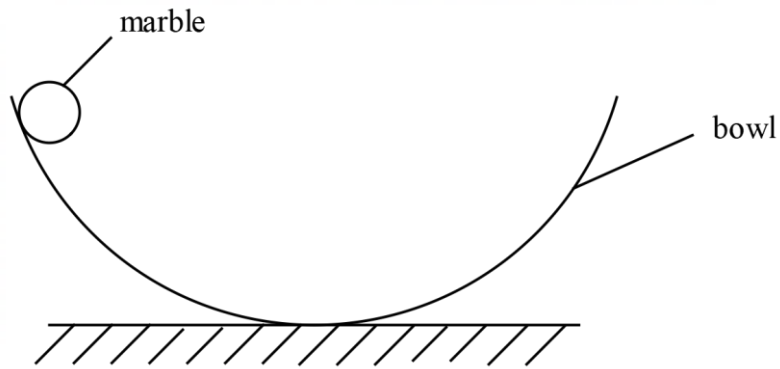
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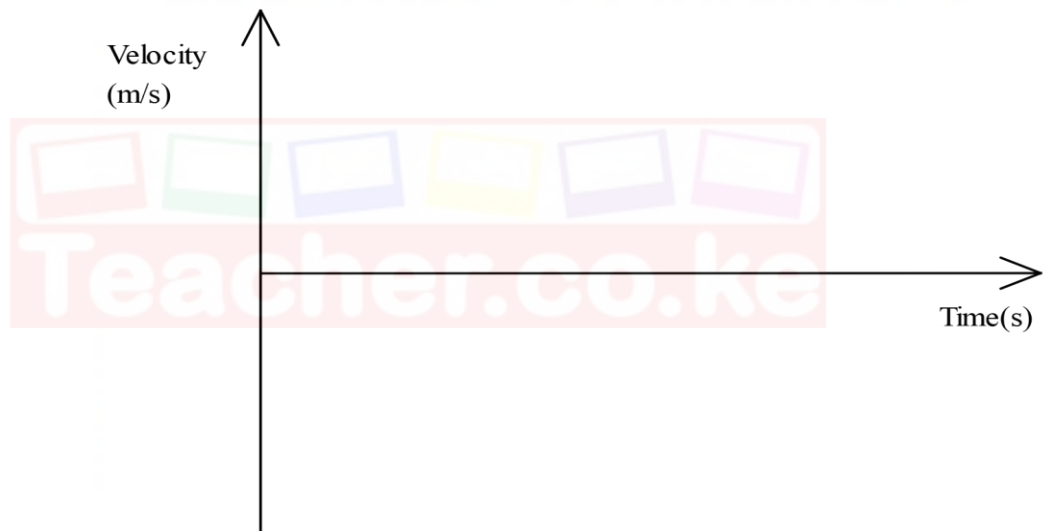
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7. **Figure 4** shows a marble that was set into oscillations when released in a bowl.



**Figure 4**

On the axes provided, sketch the velocity-time graph for the motion of the marble in one complete oscillation. (3 marks)



8. State the meaning of the term *viscosity* as used in fluids. (1 mark)

(1 mark)

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9. A machine raises a mass of 20 kg through a distance of 0.2 m when an effort of 100 N is moved through a distance of 0.32 m. determine the velocity ratio of the machine. (2 marks)

(2 marks)

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10. A gas bubble is released at the bottom of a pond containing water. It is observed that as the bubble rises to the water surface, it expands. Explain this observation. (2 marks)

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11. A stone of mass 200 g is tied at the end of a string 1 m long is whirled in a horizontal circle at an angular velocity of 10 radians per second. Determine the centripetal force acting on the stone.

(3 marks)

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12. An object is released into a eureka can full of water. It is observed that the weight of the displaced water is equal the weight of the object. Explain this observation. (2 marks)

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13. A student observed that smoke particles in a smoke cell move randomly. State what:

(a) causes this motion; (1 mark)

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(b) happens to the motion of the particles if the temperature in the cell is increased.

(1 mark)

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**SECTION B (55 marks)**

Answer **all** the questions in this section in the spaces provided.

14. (a) (i) State the meaning of the term *relative density*. (1 mark)

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- (ii) State **two** areas of application of relative density in daily life. (2 marks)

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- (b) A student blew air into a balloon, tied it up and released it into the air. It floated for some time but slowly descended to the ground and settled.

- (i) Explain why the balloon settled on the ground. (2 marks)

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- (ii) State **two** ways in which the balloon could be made to keep floating in the air.

(2marks)

- (c) A hollow metallic cube of volume  $1000 \text{ cm}^3$  is submerged in a liquid of density  $1100 \text{ kgm}^{-3}$ . Determine the upthrust acting on it. (take  $g$  as  $10 \text{ Nkg}^{-1}$ ) (3 marks)

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15. (a) During an experiment to verify a certain law, a student was provided with some masses, a spring and a metre rule.

(i) State the law the student wanted to verify. (1 mark)

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(ii) State **one** other apparatus the student needed in order to carry out the experiment. (1 mark)

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(iii) Explain how the measurements taken during the experiment are used to verify the law in part (i) above. (3 marks)

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(b) A load of 0.04 N causes an extension of 0.4 cm on a certain spring. Determine the load that will cause an extension of 0.6 cm on the same spring. (3 marks)

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- (c) A student was provided with a piece of wire and asked to make a spring. After coiling the wire on a rod, the spring appeared as shown in **Figure 5**.

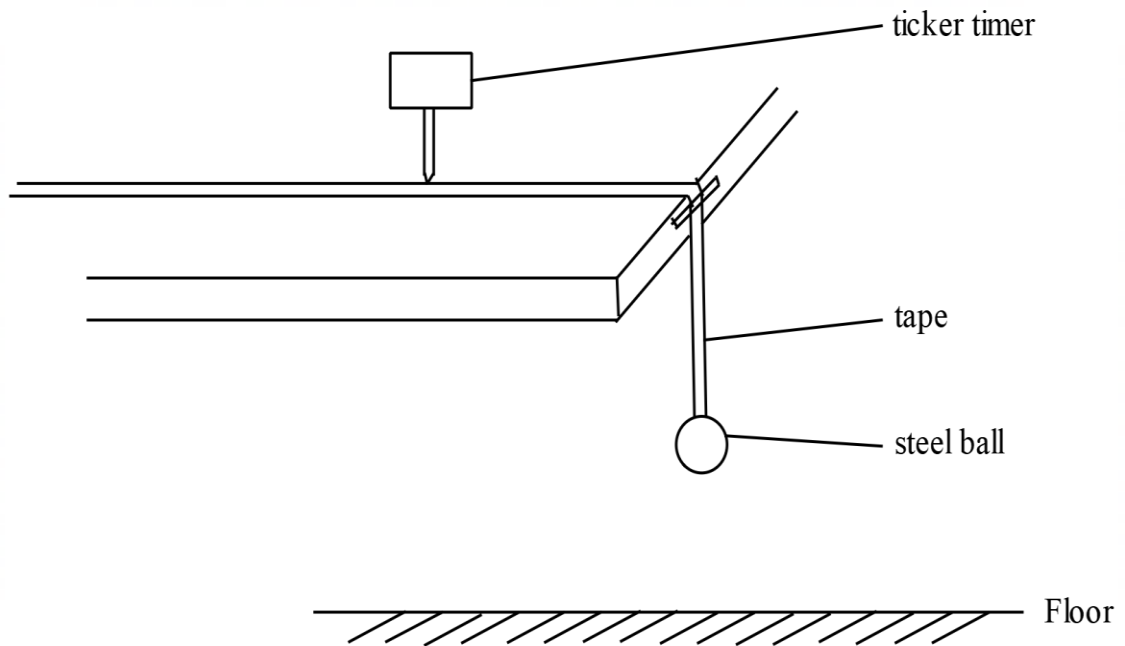


**Figure 5**

State **two** ways in which the student can modify the spring to make it stiffer.

(2 marks)

16. (a) **Figure 6** shows a setup that may be used to determine acceleration due to gravity.



**Figure 6**

Describe how the set up may be used to determine the acceleration due to gravity. (4 marks)

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- (b) A stone of mass 0.02 kg tied at the end of a spring is whirled in a vertical circle of radius 1.0 m. Determine the minimum velocity required for the stone to maintain circular motion. (*acceleration due to gravity is  $10 \text{ ms}^{-2}$* ). (4 marks)

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- (c) State **two** applications of centripetal force. (2 marks)

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17. (a) It is observed that when salt is sprinkled onto the surface of ice at  $-2 \text{ }^\circ\text{C}$ , the ice melts. Explain this observation. (2 marks)

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- (b) State **two** factors that determine the pressure exerted by solids. (2 marks)

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- (c) (i) A person mixed 2 kg of hot water at  $70\text{ }^{\circ}\text{C}$  with 3 kg of cold water at  $22\text{ }^{\circ}\text{C}$  for bathing. Given that the specific heat capacity of water is  $4200\text{ JkgK}^{-1}$ , determine the final temperature of the mixture, assuming there was no heat loss. (3 marks)

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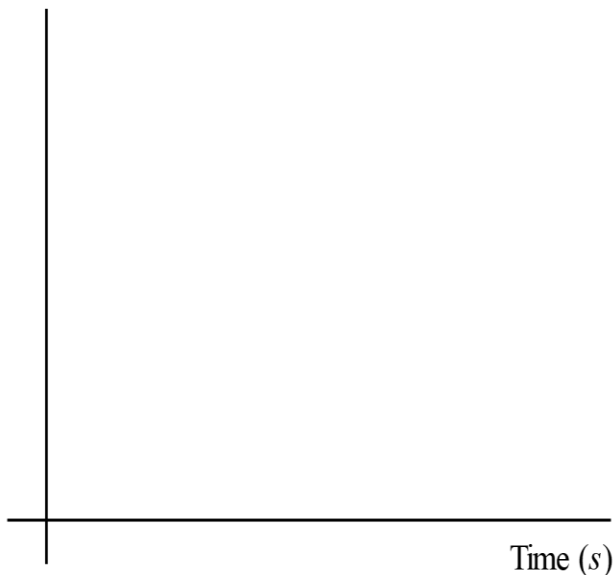
- (ii) State **two** possible factors that can lead to heat loss in (i). (2 marks)

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- (d) Some water at  $60\text{ }^{\circ}\text{C}$  was heated until it started to boil after time  $t$  seconds.

- (i) On the axes provided, sketch a graph of temperature against time for the water till it boiled. (2 marks)

Temperature  $^{\circ}\text{C}$



(ii) Explain the shape of the graph in (i). (2 marks)

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18. (a) Explain why the walls of a dam are thicker at the bottom than at the top. (3 marks)

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(b) Figure 7 shows a simple hydraulic lift system.

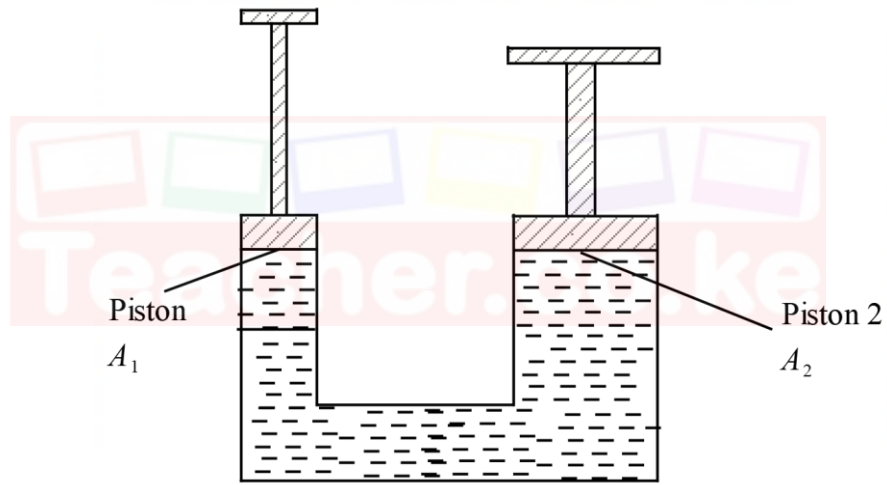


Figure 7

(i) Given that the areas  $A_1$  and  $A_2$  are  $0.2 \text{ m}^2$  and  $4 \text{ m}^2$  respectively, determine the maximum load that can be lifted at piston 2, when a force of  $200 \text{ N}$  is applied at piston 1. (3 marks)

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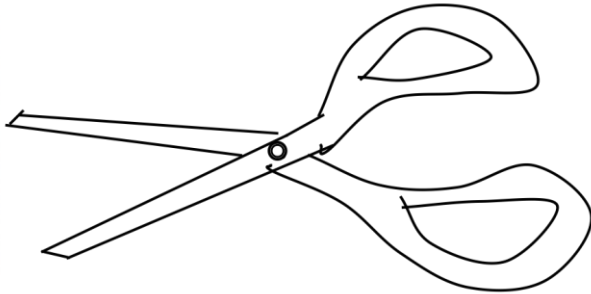
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(ii) State **two** reasons why water is not a suitable liquid for use in this system. (2 marks)

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(c) **Figure 8** shows a pair of scissors.



**Figure 8**

(i) On the diagram, label the load, effort and fulcrum. (1 mark)

(ii) Explain how the velocity ratio of the given pair of scissors may be reduced. (2 marks)

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(iii) State the reason why it is important to minimize the velocity ratio. (1 mark)

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