

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.

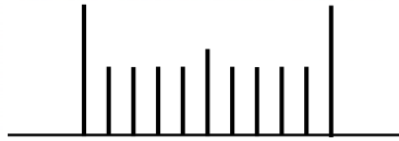


Figure 1

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.

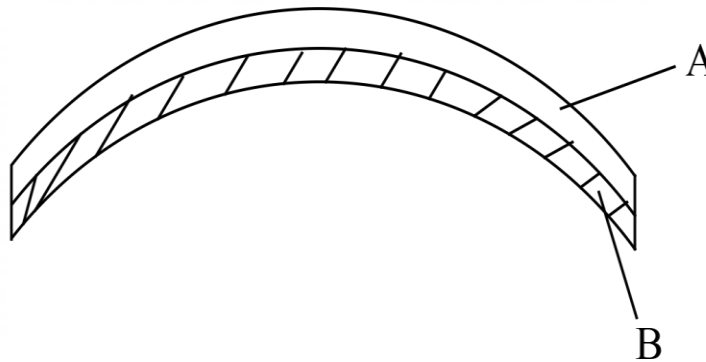


Figure 2

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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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.

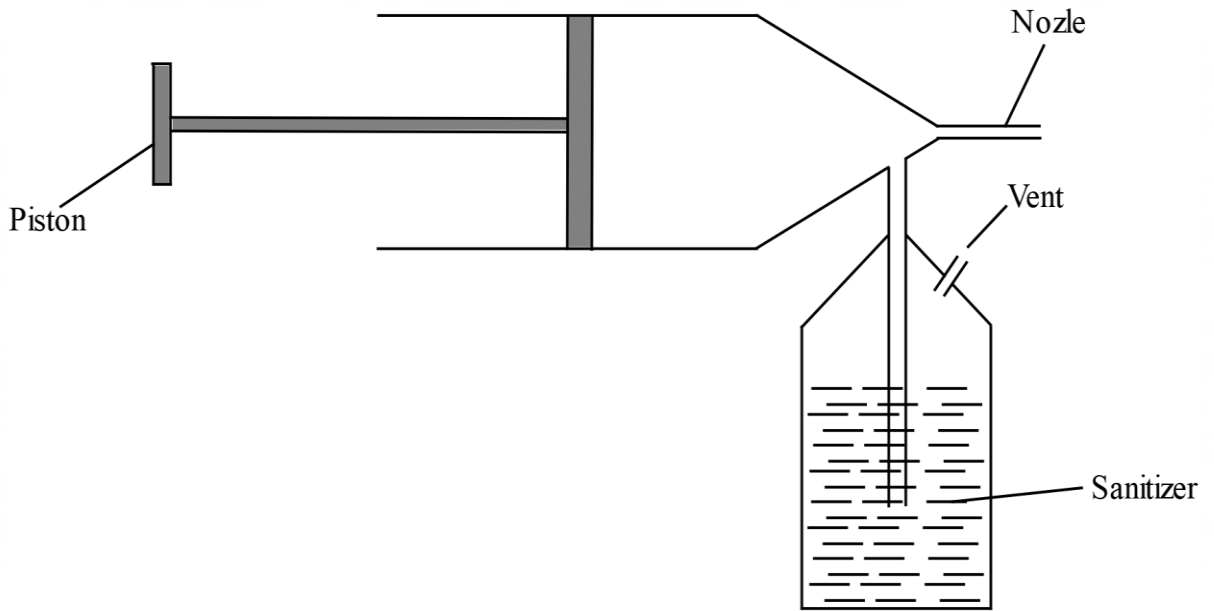


Figure 3

Explain how it works. (3 marks)

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

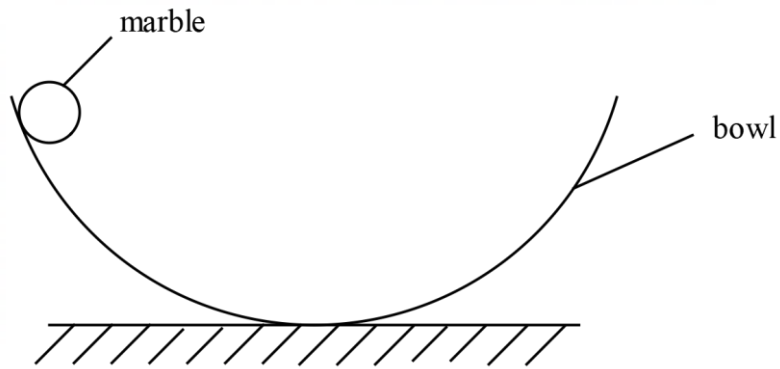


Figure 4

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)

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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)

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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 cm^3 is submerged in a liquid of density 1100 kgm^{-3} . Determine the upthrust acting on it. (*take g as 10 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.

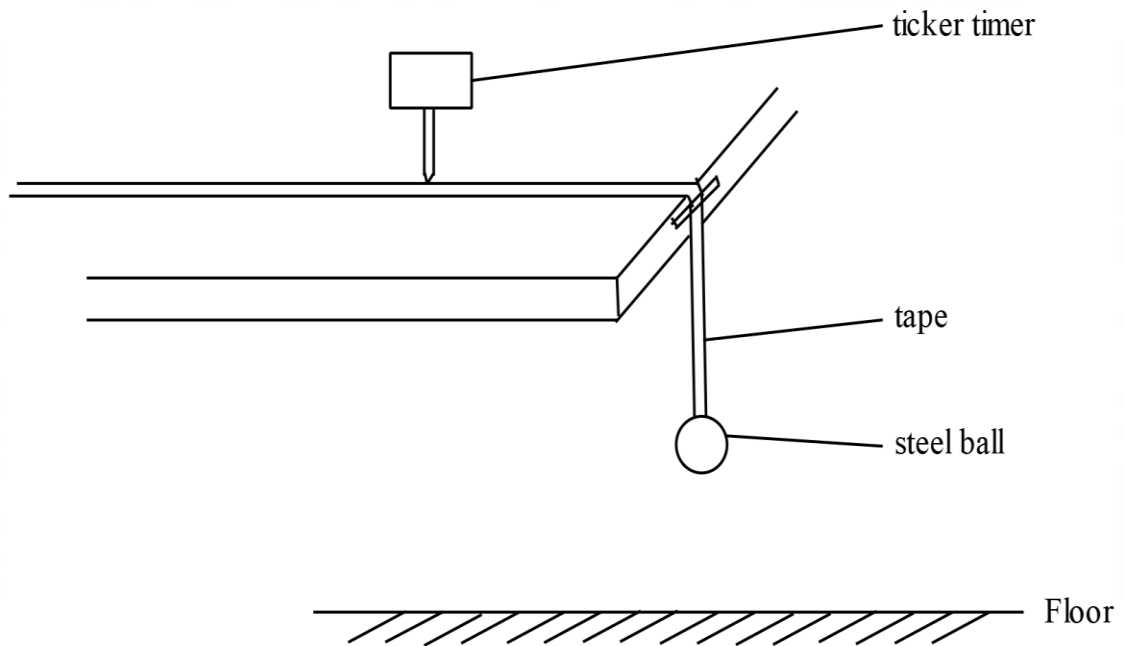


Figure 6

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 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 °C with 3 kg of cold water at 22 °C for bathing. Given that the specific heat capacity of water is 4200 $JkgK^{-1}$, determine the final temperature of the mixture, assuming there was no heat loss. (3 marks)

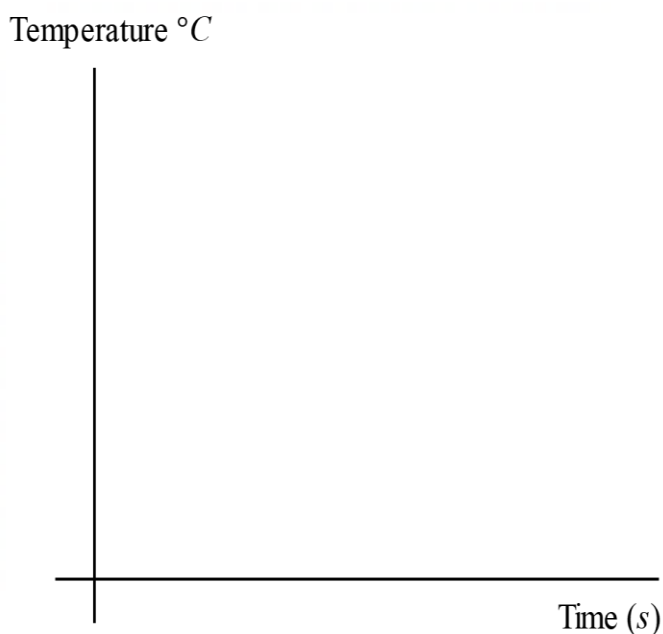
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(ii) State **two** possible factors that can lead to heat loss in (i). (2 marks)

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(d) Some water at 60 °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)



(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.

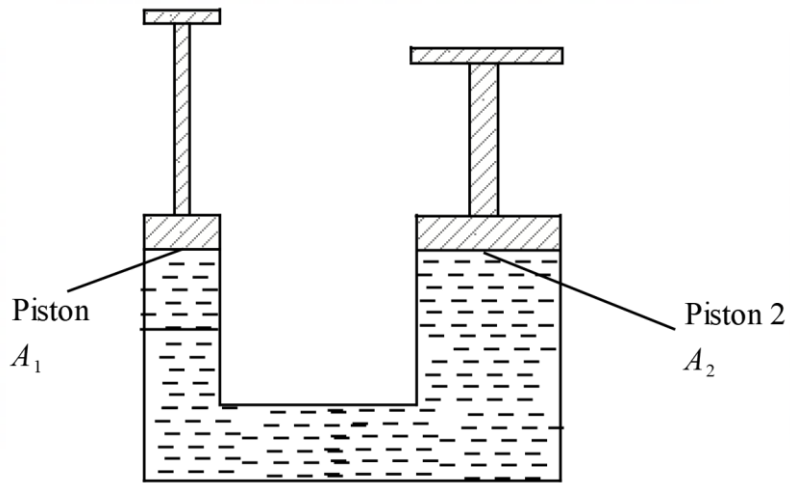


Figure 7

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

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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.

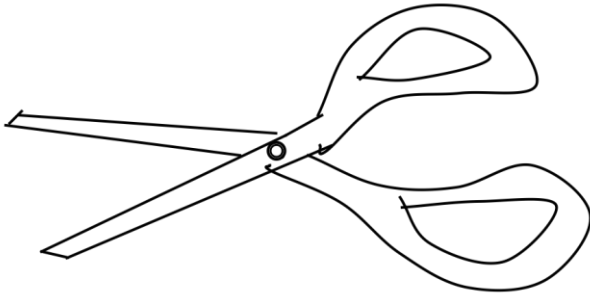


Figure 8

(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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