Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2010
Secondary Three

PHYSICS **1 hour 45 minutes**

Paper 2 Theory Paper **1000 - 1145**

Monday **18 October 2010**

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.
Write your name, register number and class in the spaces at the top of this page and on any separate answer paper used.

Section A (40 marks)
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B (30 marks)
Answer **all** questions.
Write your answers in the spaces provided.

Assume g = 10 m/s^2, unless specified otherwise by the questions.

INFORMATION FOR CANDIDATES

The intended number of marks is given in the brackets [ ] at the end of each question or part question. You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

Examiner's Use	
Section A	
Section B	
10	
11	
12	
Total	

This document consists of **17** printed pages.

Section A

Answer **all** questions.

Write your answers in the spaces provided.

1 Fig. 1.1 shows a cube of dimensions 2.0 cm, 3.0 cm and 4.0 cm.

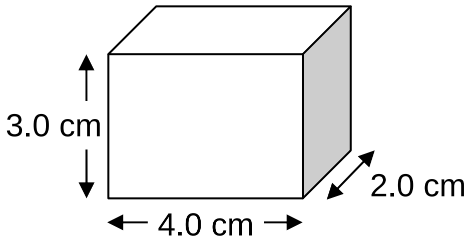


Fig. 1.1

(a) Given the mass of the cube to be 36 g, calculate the density of the cube. [2]

(b) The cube sinks when placed in water. Explain why this is so.

……………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

(c) Complete the following table to show how the following physical quantities would change, if at all, if the cube were taken to the Moon.

The first one has been answered for you. [2]

Physical quantity	**Increase**	**No change**	**Decrease**
Dimensions of cube		✓	
Mass of cube		✓	
Weight of cube			✓
Density of cube		✓	

2 Fig. 2.1 shows the velocity-time graph of a car moving from 1 set of traffic lights to the other.

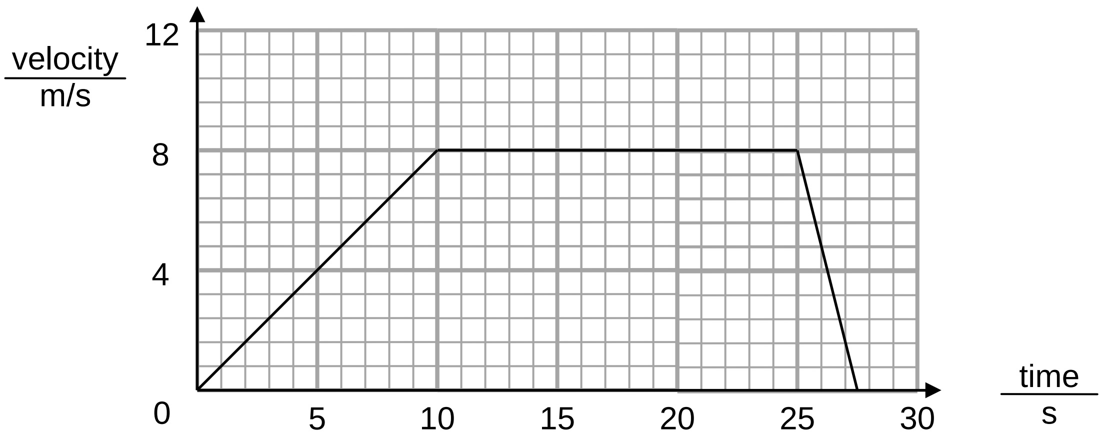


Fig. 2.1

(a) What is the distance between the 2 traffic lights?

distance = ……………………….. [2]

(b) During which interval of time is the rate of change of speed greatest?

…………………………………………………………………………………………[1]

(c) Calculate the average speed over the whole journey.

average speed = …………………. [1]

3 Fig. 3.1 shows a 30 N weight being supported by two strings from a ceiling. The tension forces in the two strings are $\mathbf{T_1}$ and $\mathbf{T_2}$.

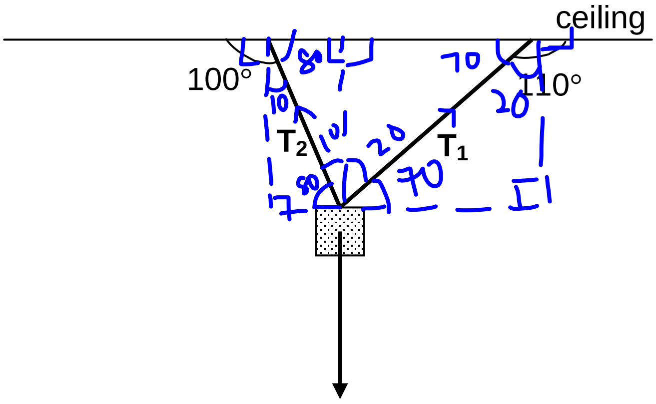


Fig. 3.1

(a) On Fig. 3.1, label the directions of $\mathbf{T_1}$ and $\mathbf{T_2}$ in the strings acting on the weight. [1]

(b) With the aid of a scale diagram, determine the magnitudes of $\mathbf{T_1}$ and $\mathbf{T_2}$.

T_1 = …………………, **T_2** = ………………… [3]

4 A boy who weighs 500 N stands on a uniform plank with supports at **P** and **Q**. The weight of the plank is 100 N and the separation between the boy and the supports are as shown in Fig. 4.1.

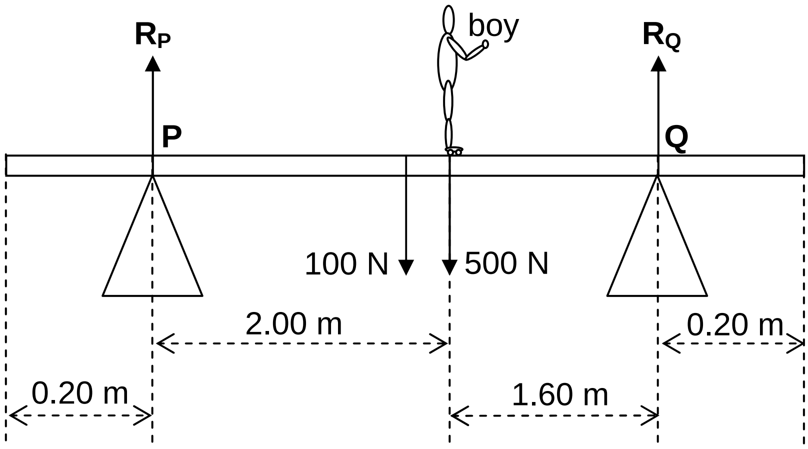


Fig. 4.1

Determine the normal reactions, **R_P** and **R_Q**.

normal reaction, **R_P** = …………………

normal reaction, **R_Q** = …………………

[4]

5 Fig. 5.1 shows the top view of 2 mirrors, $\mathbf{M_1}$ and $\mathbf{M_2}$, placed at right angles to each other. A solid rectangular block with a spot, **S**, painted on one side is placed between these mirrors.

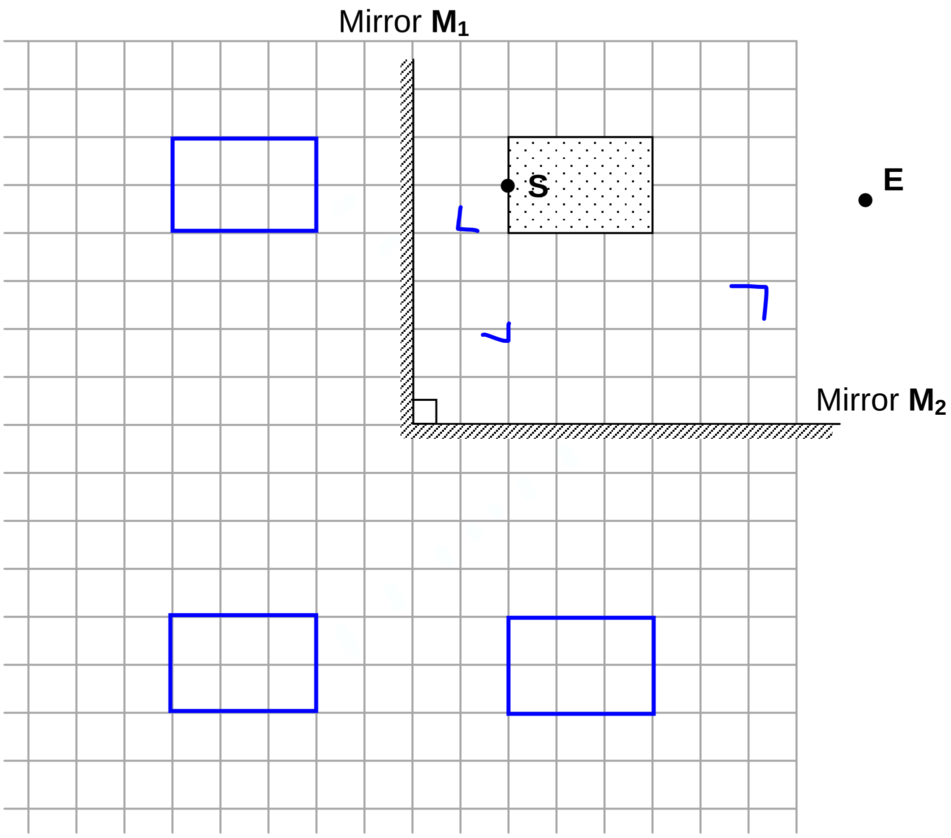


Fig. 5.1

(a) Complete Fig. 5.1 to show the positions of the three images of the block that are formed in the two mirrors. [2]

(b) On Fig. 5.1, draw a light ray to show how the observer, **E**, is able to see the reflection of the spot, **S**, after the light ray is reflected by both mirrors $\mathbf{M_1}$ and $\mathbf{M_2}$. [2]

6 Fig. 6.1 shows the structure of a simple periscope used to see over the crowds at the Youth Olympic Games.

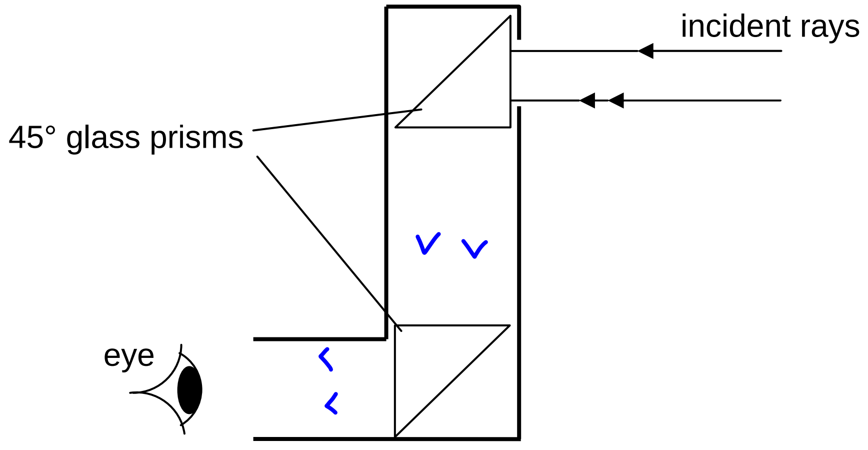


Fig. 6.1

When the periscope is used, total internal reflection occurs in the glass prisms.

(a) State the conditions required for **total internal reflection** to take place.

…………………………………………………………………………………………….

…………………………………………………………………………………………….

……………………………………………………………………………………………[2]

(b) On Fig. 6.1, complete the paths of the 2 incident rays through the periscope into the eye. [2]

(c) Different types of glass have different refractive indices. In choosing a suitable glass to use for the prisms in the periscope, a critical angle of less than 45° is required.

Calculate the refractive index that will give a critical angle of 45°.

refractive index = ……………………….[1]

7 In Fig. 7.1, a convex lens, **L**, is used to view the image, **I**, of an arrow object, **O**.

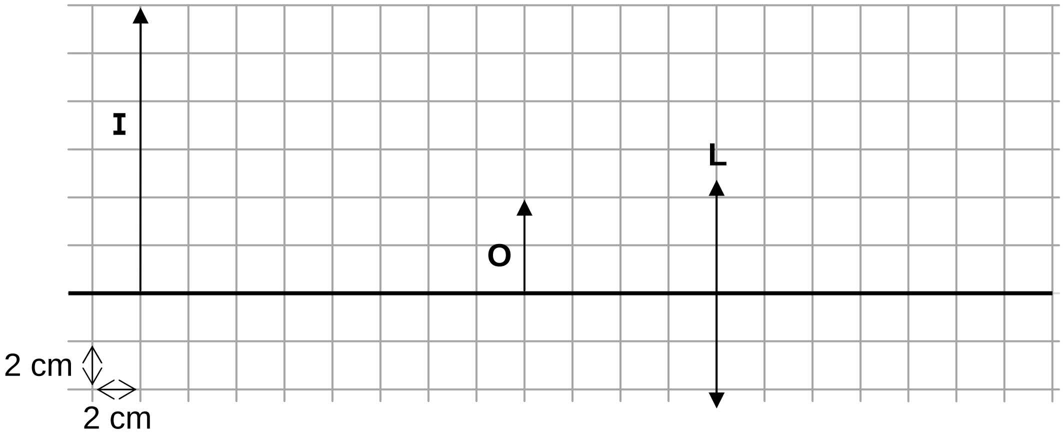


Fig. 7.1

(a) Explain what is meant by the *focal length of a convex lens*.

……………………………………………………………………………………………

……………………………………………………………………………………………[1]

(b) Fig. 7.1 is drawn to scale such that 1 square = 2 cm.

(i) By drawing a ray diagram, determine the position of the principal focus. Label the position **F**. [2]

(ii) State the focal length of the convex lens.

focal length = ………………….. [1]

(c) State one application for such a lens being placed near to the object as shown above in Fig. 7.1.

……………………………………………………………………………………………[1]

8 Fig. 8.1 shows a series of floating balls which are used to limit the swimming area outside a beach. The balls are linked by identical light strings of length 1.0 m. A water-wave of small amplitude approaches from the left moving right as shown.

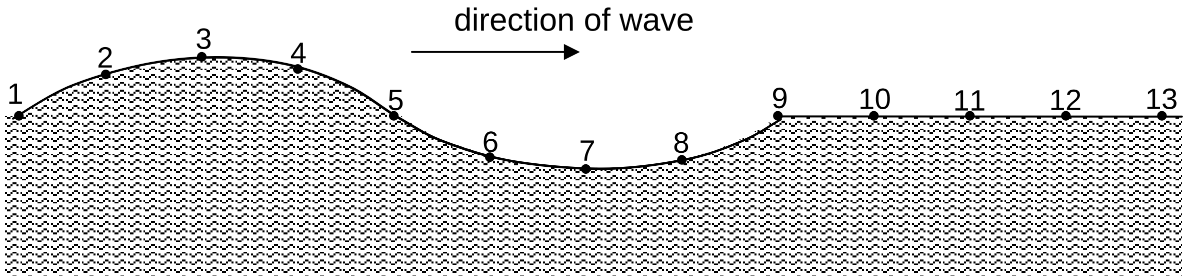


Fig. 8.1

(a) State the type of wave shown in Fig. 8.1.

……………………………………………………………………………………………[1]

(b) State the direction of motion of ball 5 at the instant shown in Fig. 8.1.

……………………………………………………………………………………………[1]

(c) When the wave reaches ball 10, state the initial direction in which this ball starts to move.

……………………………………………………………………………………………[1]

(d) It is observed that ball 5 makes one complete oscillation in 5.0 s. Calculate the frequency of the wave.

frequency = …………………………. [1]

(e) Calculate the speed of the wave.

speed = ……………………… [1]

(f) Ball 13 is in a much shallower water than the other balls. Comment on the frequency of this ball compared to the frequency calculated in **(d)**.

……………………………………………………………………………………………[1]

9 Fig. 9.1 shows the waveform of a sound wave.

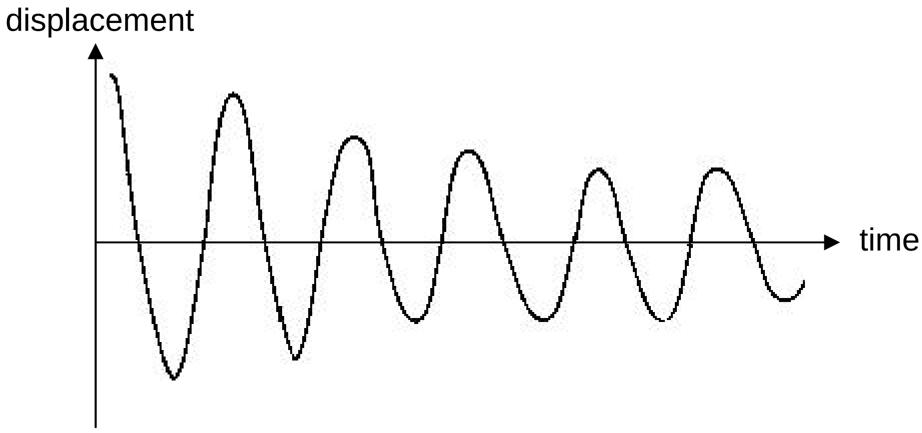


Fig. 9.1

(a) Explain whether the sound is getting louder or quieter.

……………………………………………………………………………………………………

……………………………………………………………………………………………………[2]

(b) Explain how you can tell from the waveform that the pitch of the sound has been constant.

……………………………………………………………………………………………………

……………………………………………………………………………………………………[1]

Section B

Answer **all** questions in this section.

10 Fig. 10.1 shows a conveyer belt in an airport. When a cargo box of mass 18.0 kg is placed at position **P**, the box undergoes uniform acceleration from rest to 4.0 m/s at position **Q**.

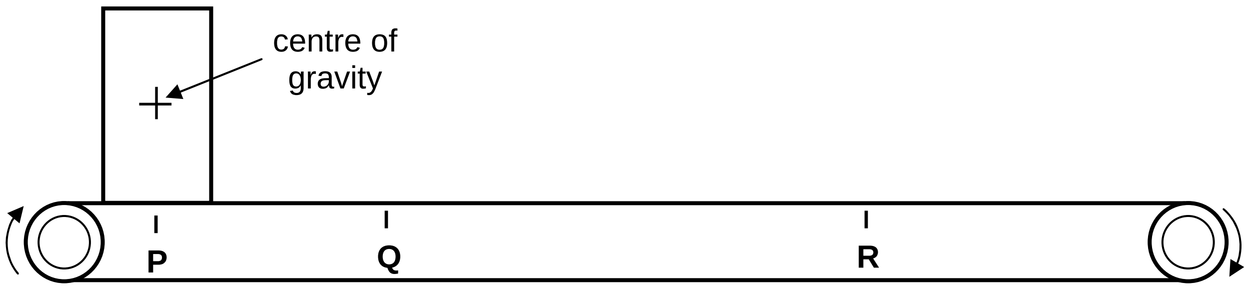
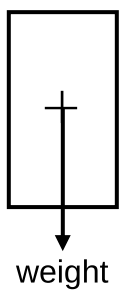


Fig. 10.1

Throughout the entire motion, the box and the conveyer belt move together without slipping.

(a) In the space provided below, draw a free-body diagram to show all other forces acting on the box as it moves between positions **P** and **Q**. Name all the forces. [2]



(b) If the box takes 5.0 s to travel from position **P** to position **Q**, calculate the resultant force acting on the box.

force = …………………..[2]

(c) The box travels at uniform velocity of 4.0 m/s between positions **Q** and **R**. When it reaches position **R**, the conveyer belt suddenly stops moving and the box tilts forward as shown in Fig. 10.2.

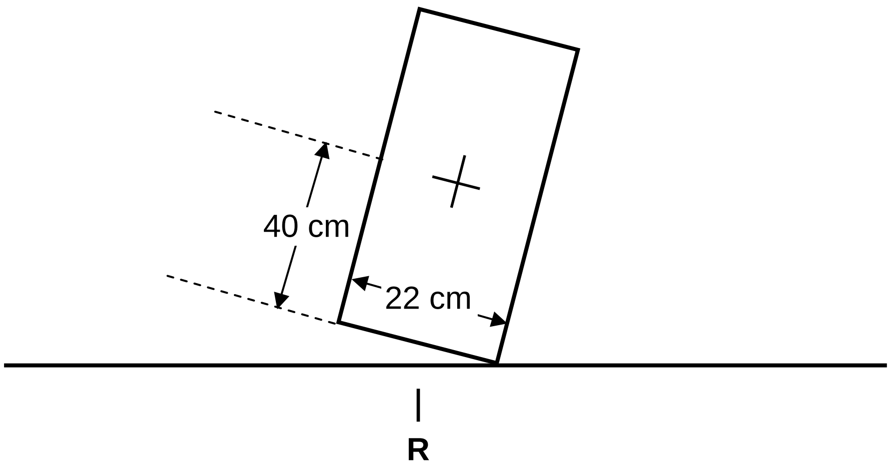


Fig. 10.2

(i) Explain why the box tilts forward.

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………[2]

(ii) Given that the width of the base of the box is 22 cm and the centre of gravity of the box is 40 cm from the base, calculate the maximum angle of tilt of the box before it falls over.

angle = …………………..[2]

(d) The box eventually topples over as shown in Fig. 10.3.

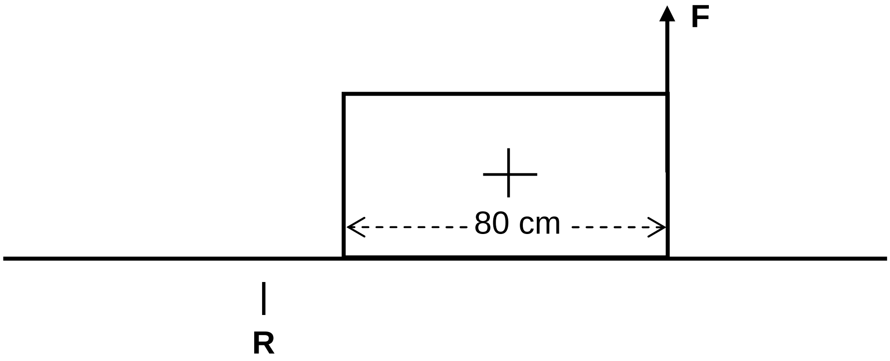


Fig. 10.3

Determine the minimum vertical force, **F**, needed to lift the box upright.

F = …………………………..[2]

11 Fig. 11.1 shows a diver jumping into the air from the springboard of a swimming pool. The diver jumps into the air, reaches the highest point and falls.

Assume air resistance is negligible.

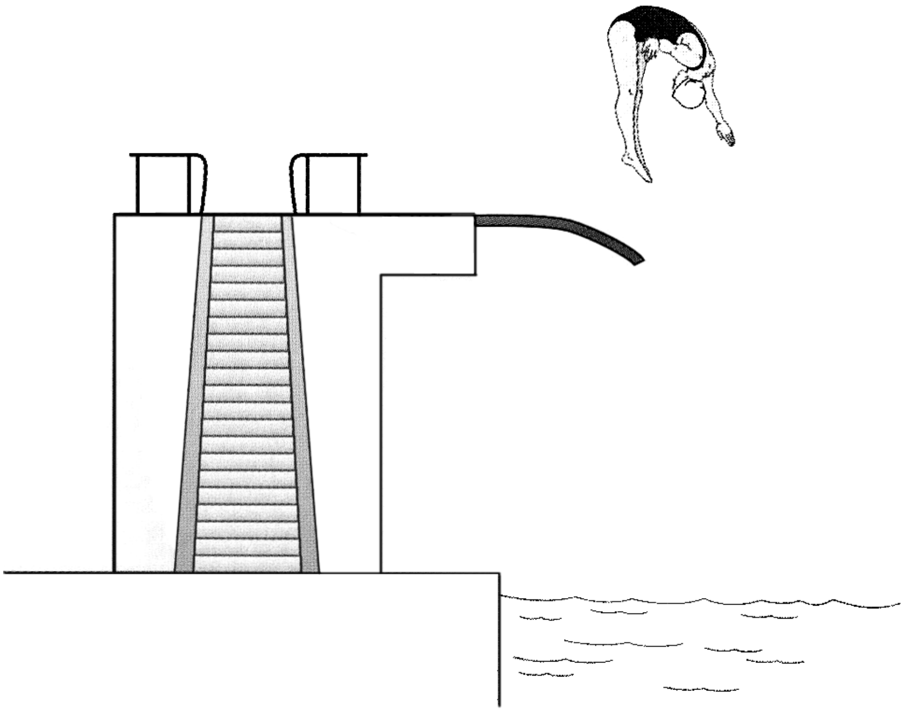


Fig. 11.1

The mass of the diver is 50.0 kg and she takes 0.70 s to reach the highest point of her jump.

(a) Calculate the weight of the diver.

weight = ……………… [1]

(b) State the magnitude and direction of the force acting on the diver at the instant when she **just leaves** the springboard.

……………………………………………………………………………………………….[1]

(c) Calculate the speed at which she leaves the spring board.

speed = ……………………….[2]

(d) From the highest point of her jump, she takes 1.04 s to reach the water.

Determine

(i) the speed she enters the water,

speed = ………………………..[2]

(ii) the height of the spring board above the water.

height = ………………………..[2]

(e) Another girl who has half the mass, jumps up from the spring board with the same speed. Explain whether she will be able to reach the same height.

……………………………………………………………………………………………

……………………………………………………………………………………………

…………………………………………………………………..……………………..[2]

12 As shown in Fig. 12.1, a metal block of mass 0.50 kg, placed on the top of a 4.0 m high table, is given a slight push at position **A** and hence moves with an initial velocity of 4.0 m/s at position **A**.

The block moves over a horizontal distance of 3.0 m and reaches position **B** with a lower speed, just before it drops off the edge of the table top and hits on the floor. The friction between the block and the table is assumed to be a constant 1.0 N.

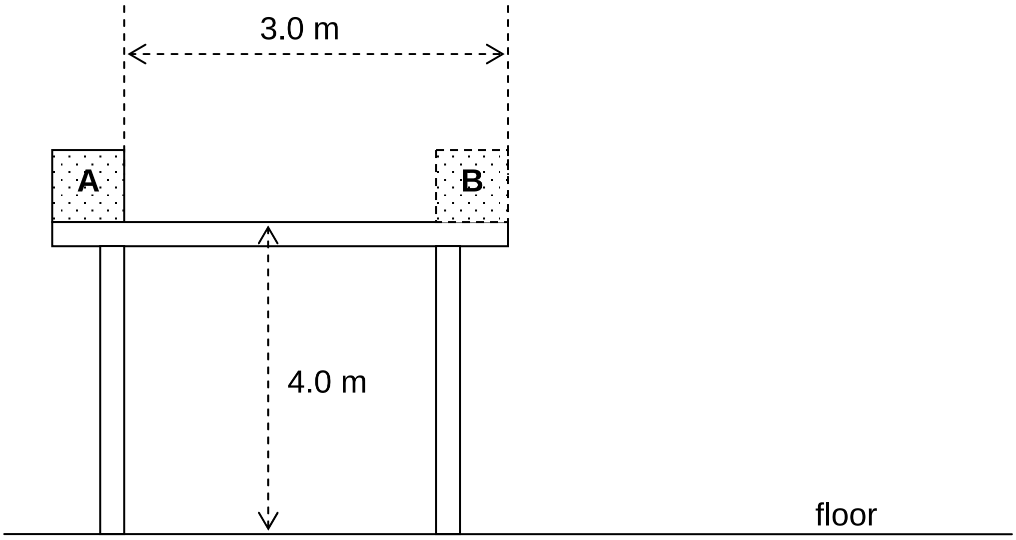


Fig. 12.1

(a) State the principle of conservation of energy.

…………………………………………………………………………………………………

…………………………………………………………………………………………………[1]

(b) Determine the gravitational potential energy of the block when it is first placed on the table top.

potential energy = …………………… [2]

(c) Determine the kinetic energy of the block

(i) at position **A**,

kinetic energy = ………………………..[2]

(ii) at position **B**,

kinetic energy = ………………………..[2]

(iii) just before the block hits the floor.

kinetic energy = ………………………..[2]

(d) What happens to the kinetic energy of the block on hitting the floor?

……………………………………………………………………………..……………………[1]

- End of Paper -