Class	Register Number	Name

南洋女子中学校

NANYANG GIRLS' HIGH SCHOOL
End-of-Year Examination 2015
Secondary Three

PHYSICS **1 hour 45 minutes**

Paper 2 Theory Paper **09:15 – 11:00**

Friday **09 October 2015**

No additional materials are required.

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.

Write in dark blue or black ink.
You may use a pencil for any diagrams or graphs.
Do not use correction fluid or tape.

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. Question **11** has a choice of parts to answer: **11** ***Either*** **or 11** ***Or*****.**
Write your answers in the spaces provided on the question paper.

At the end of the examination, **circle 11 Either** or **11 Or** in the grid on the right to indicate which question you have answered.

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.

Candidates are reminded that **all** quantitative answers should include appropriate units. Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.
The use of an approved scientific calculator is expected, where appropriate.

The gravitational field strength g is 10 N kg^{-1} (near the Earth's surface).

Examiner's Use	
Paper 2	
1	
2	
3	
4	
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6	
7	
8	
9	
10	
11 Either	
11 Or	
Total	

Paper 1	

Overall
%

Section A (40 marks)
Answer **all** questions.

Write your answers in the spaces provided.

1 Mrs Tan went to buy some durians. She noticed the seller weighed each durian individually and added the masses of the durians together to obtain the total mass.

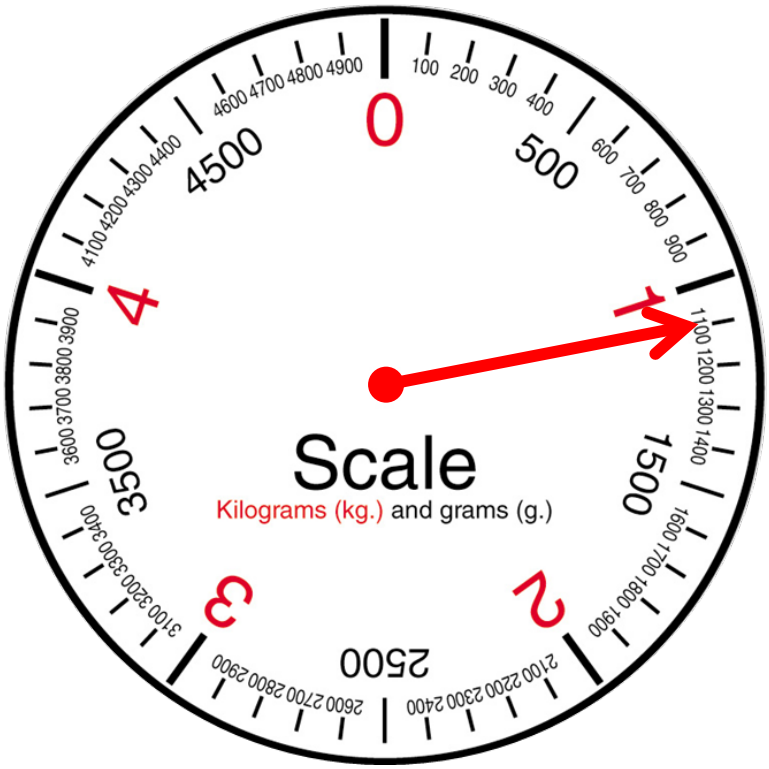

Fig. 1.1

(a) The scale shown in Fig. 1.1 was used to weigh a durian. Record the mass of the durian that is shown on the scale to the correct precision in kg.

mass of durian = …… [1]

(b) Mrs Tan bought 4 durians. When she weighed them altogether at home, the scale showed a mass that was 100 g less than what she was charged for. State if Mrs Tan's method of weighing the durians will give a more accurate mass than the seller's method. Explain the reasoning behind your answer. Assume that both scales have the same precision and accuracy.

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……

……

…… [3]

2 In a journey along a straight road, a car accelerates uniformly from rest to 46.4 m s^{-1} in 10.0 s. It then travels at this constant speed for 500 m before decelerating uniformly to rest in 20.0 s.

(a) Calculate the acceleration of this car in the first 10.0 s.

acceleration = ……[2]

(b) Determine the time taken by the car to travel the 500 m in the middle of the journey.

time taken = ……[2]

(c) Using the axes below, sketch and label a graph to show how the speed of the car varies with time during the entire journey. Indicate the speed and time clearly for each stage of the journey. [2]

3 Fig. 3.1 shows three blocks lying on a smooth horizontal surface. The blocks A, B and C have mass of 4.0 kg, 3.0 kg and 2.0 kg respectively. A pushing force *P* is exerted on block A as shown.

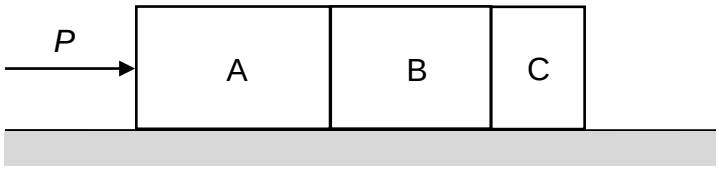


Fig. 3.1

(a) Calculate the horizontal force *P* needed to accelerate the blocks at 2.1 m s^{-2}.

F = ……[1]

(b) Determine the force exerted on A by B.

force = ……[2]

(c) Determine the net force on *C.*

net force = ……[1]

4 A force *F* is applied horizontally on a 26 kg box to keep it at rest on a frictionless inclined plane as shown in Fig. 4.1.

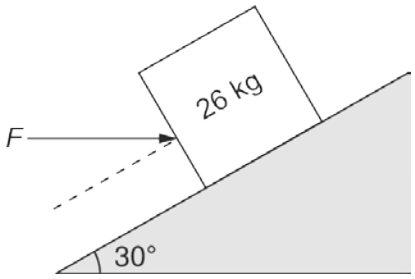


Fig. 4.1

(a) On Fig. 4.1, draw and label two other forces acting on the box. [1]

(b) Hence, sketch a vector diagram (not to scale) to show the vector addition of all the forces acting on the box to keep it at rest. Clearly label the forces and angles. [3]

(c) Without the addition of other forces, suggest how you may modify the way the force *F* is applied to keep the box at rest on the plane, such that *F* has a smaller magnitude.

……

…….. [1]

5 **(a)** State the *principle of moments*.

……

……

……[1]

Fig. 5.1 shows a baby mobile that hangs by a string from the ceiling. Objects P, Q, R and S hang from 3 rods. The toy is completely stationary and the rods are horizontal. The weights of the strings and the rods may be neglected.

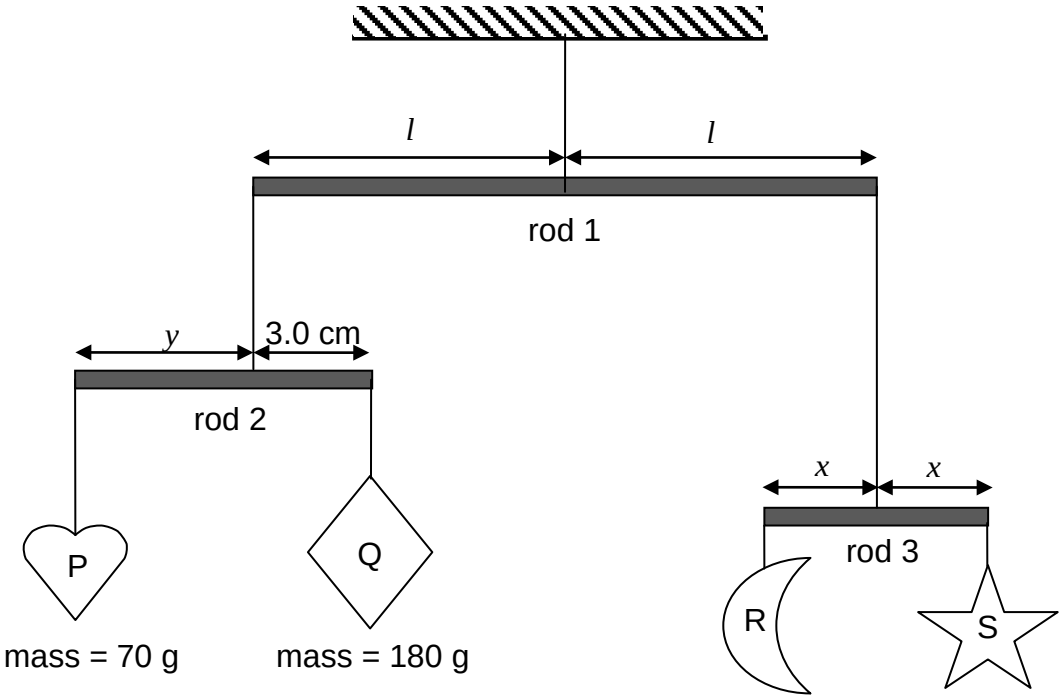


Fig. 5.1

(b) Calculate length y.

length y = …… [2]

(c) Determine the mass of R and S.

mass of R = ……; mass of S = …… [2]

(d) If object R drops off, state what will happen to rod 1 and rod 3.

rod 1: ……

……[1]

rod 3: ……

……[1]

6 A bubble of gas rises 40.0 m from a diver to the surface of a lake, as shown in Fig. 6.1.

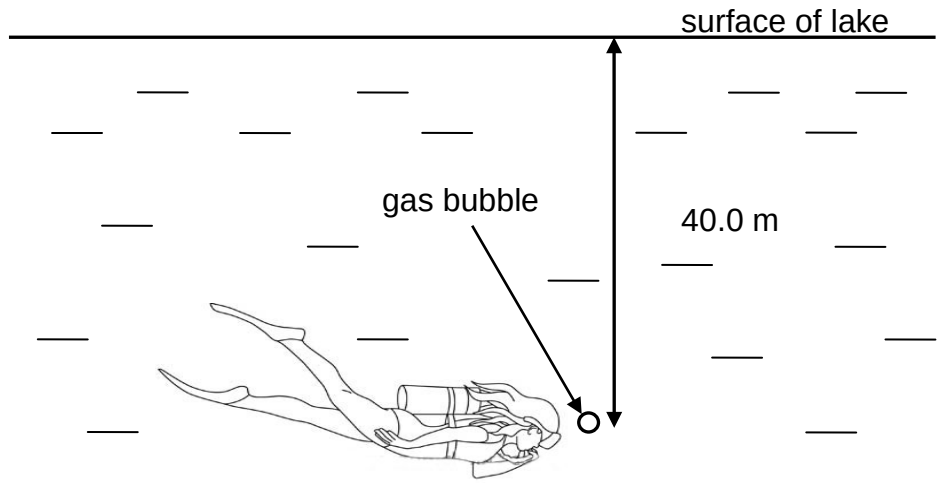


Fig. 6.1

(a) If atmospheric pressure is 101 kPa and the density of the lake water is 1000 kg m^{-3}, calculate the air pressure inside the bubble at the depth of 40.0 m in pascal.

air pressure =……[3]

(b) State and explain how the volume of the bubble will change as it rises to the surface of the lake.

……

……

…… [2]

7 A car of mass 1800 kg is travelling along a straight, level road at a constant speed of 70 km h^{-1}.

(a) Calculate the kinetic energy of the car.

kinetic energy of car = …… [2]

(b) A total frictional force of 400 N is acting on the car. Determine the work done against this force in 1 minute.

work done = …… [2]

(c) Hence, determine the power of the car engine required to do work against friction.

power of engine = …… [1]

8 A letter 'F' is placed in front of a plane mirror as shown in Fig. 8.1.

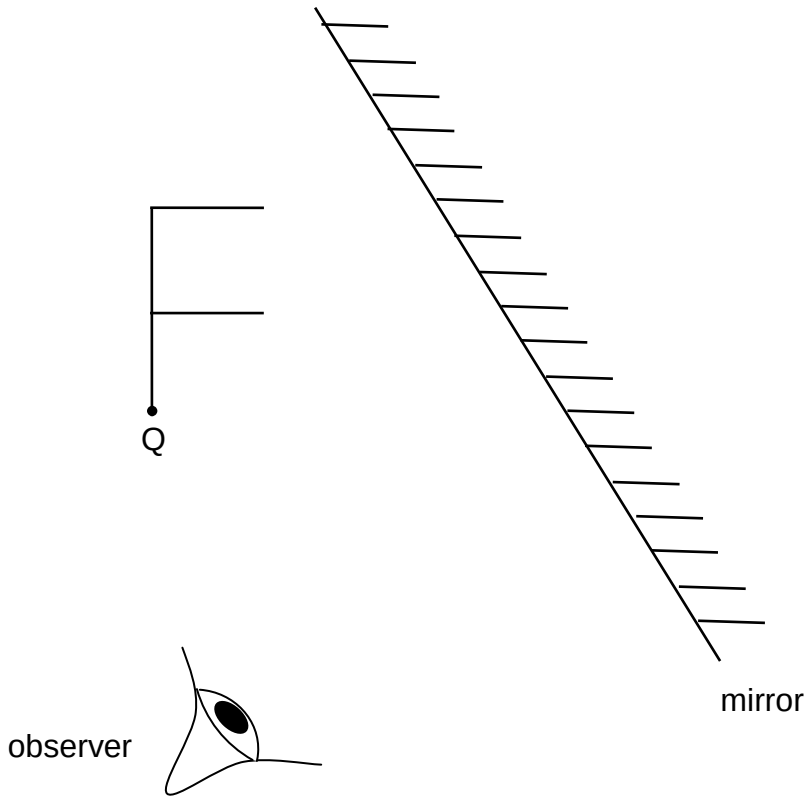


Fig. 8.1

On Fig. 8.1,

(a) locate and draw the image of 'F' . Show all construction lines clearly. [2]

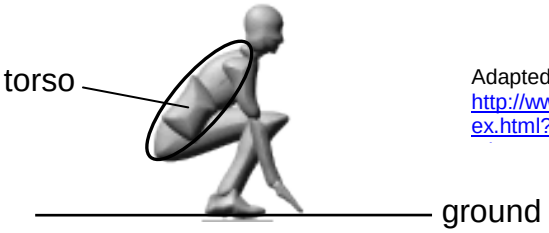
(b) draw 2 rays of light to show how the observer sees the image of point Q. [2]

Section B (30 marks)

Answer **all three** questions in this section.

Answer only **one** of the alternative questions in **Question 11**

9 A parachute trainee jumps from a platform 3.0 m high.
When he touches the ground, he bends his knees to cushion the fall as shown in Fig. 9.1.
His torso (trunk of his body) decelerates to rest over a vertical distance of 0.65 m.



Adapted from
http://www.ivencia.com/index.html?/dynamicarts/jump

Fig. 9.1

(a) Assuming air resistance is negligible, calculate

(i) the speed of the trainee just before he touches the ground,

speed = ……[2]

(ii) the deceleration of his torso to rest,

deceleration = ……[2]

(iii) the average resultant force exerted on his torso (of mass 45 kg) by his legs during the deceleration.

average force = ……[2]

The parachute trainee progressed in his course and does an actual parachute jump from an aeroplane.

Adapted from
http://c315914.r14.cf1.rackcdn.com/wp-content/uploads/2012/02/Parachutist.jpg

Fig. 9.2

During this parachute jump, the trainee's parachute opens fully as shown in Fig. 9.2.

(b) Explain clearly why he would decelerate after the parachute opens.

……

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……

…….. [2]

(c) The trainee with his parachute opened would continue to fall till he reaches a constant falling speed. Explain clearly how a constant speed is reached.

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…….. [2]

10 A student stands against a painted wall while looking into a 1.2 m wide mirror at the opposite end of a rectangular room as shown in Fig. 10.1.

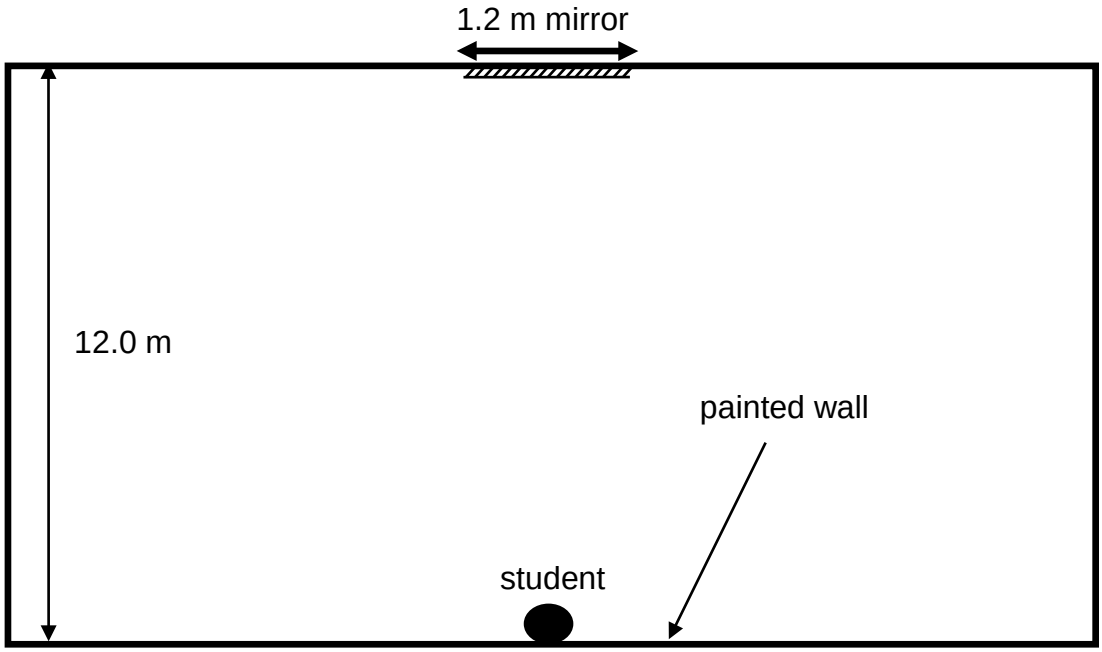

Fig. 10.1

(a) Determine the length of the painted wall the student can see in the 1.2 m mirror from her current position. Show your construction lines clearly. You may assume that the distance between the students' eyes and the mirror is 12.0 m.

length of the painted wall that can be seen = ……. [2]

(b) The student moves 5.0 m towards the mirror. Determine the length of the painted wall the student can see in the 1.2 m mirror from her new position. Show your working clearly.

new length of the painted wall that can be seen = ……. [3]

(c) Mirrors are manufactured by applying a reflective coating to the back of a sheet of glass. When light is incident on a mirror, reflection and refraction occur as shown in Fig. 10.2 below. This may produce a main image and a ghost image.

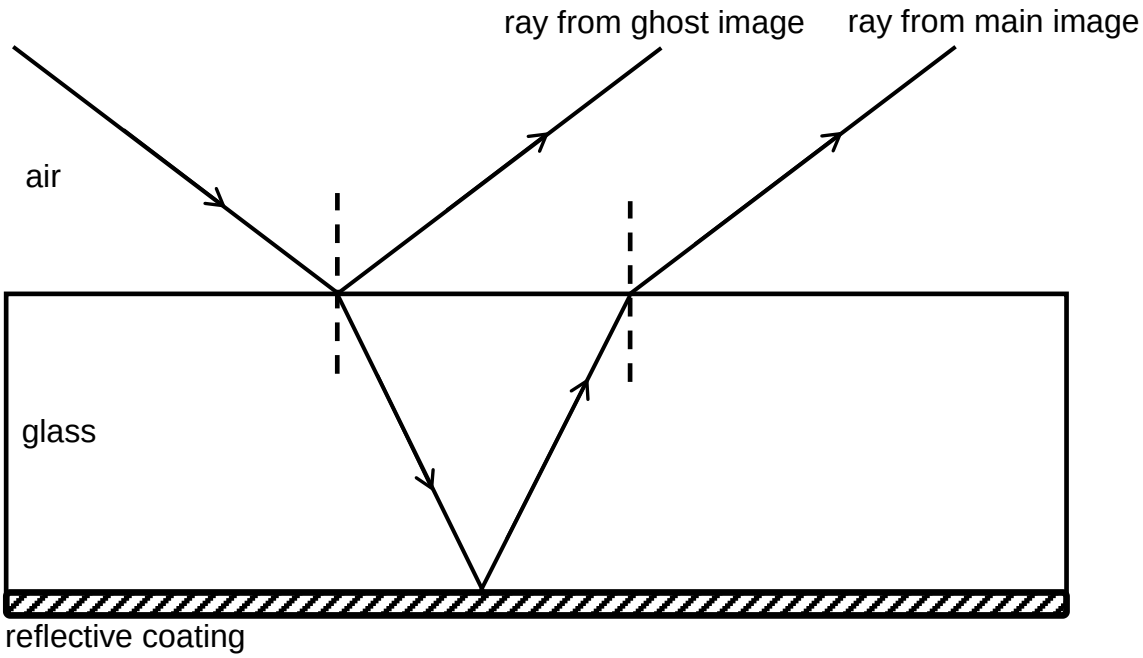

Fig. 10.2

(i) A light ray enters the glass with an angle of incidence, i. The corresponding angle of refraction is r. Label i and r on Fig. 10.2. [1]

(ii) Given that the refractive index of the glass is 1.5, calculate r when $i = 50°$.

r = ……[2]

(iii) One way to make the ghost image less obvious is to use another type of glass with a different refractive index. Explain how this solution might work.

……..

……..

……[2]

11 EITHER

Car manufacturers conduct simulations of car crashes to test the safety of car designs.

Adapted from "Physics at Work".

Fig. 11.1

In an accident simulation, a car travelling at 20 m s^{-1} collided head-on with a fixed barrier. As it came to a stop, its front crumpled by 0.60 m as shown in Fig 11.1. At the same time, the seatbelt strapping the dummy driver stretched 0.40 m horizontally.

(a) (i) Calculate the total distance taken for the dummy to come to a stop.

total distance = ……[1]

(ii) Calculate the average deceleration of the dummy during the collision.

average deceleration = ……[2]

(b) Use your answers in **(a)** to calculate the time taken for the dummy to come to a stop.

time taken = ……[2]

(c) If the dummy had a mass of 65 kg, calculate the average force exerted by the belt on the driver during the collision.

average force = ……[1]

(d) Calculate the kinetic energy of the dummy just before the collision.

kinetic energy = ……[2]

(e) Describe clearly the energy change(s) of the car which would have occurred if the dummy had applied the car brakes in time and the car stopped without colliding with the barrier.

……

……

……...[2]

11 OR

A ballerina of mass 56 kg stands en pointe on an area 1.0 cm^2 while an elephant stands on four feet each of area 120 cm^2, as shown in Fig. 11.2.
The elephant has a mass 45 times that of the ballerina.

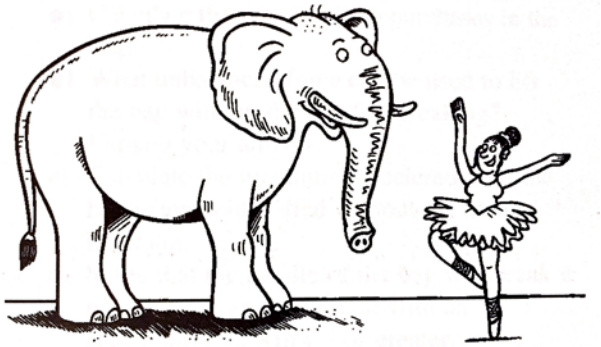

Fig. 11.2

(a) Calculate the pressure exerted on the ground by the elephant in Pa (pascal).

pressure = ……[2]

(b) In which situation is a greater pressure exerted on the ground (ballerina or elephant)? Justify your answer with a calculation.

……

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……...[2]

(c) The elephant is tasked to pull a log along the ground as shown in Fig. 11.3.

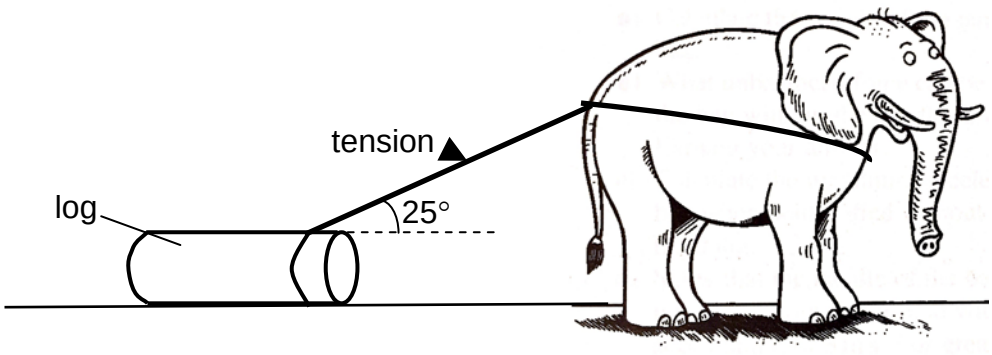

Fig. 11.3

(i) The elephant pulls the log with a tension in the rope. The friction acting on the log by the ground is 100 N. On Fig. 11.3, draw and label two other forces acting on the log. [1]

(ii) The magnitude of the tension is 1200 N acting at an angle of 25° to the horizontal.
Determine the horizontal component of the tension.

horizontal component = ……[2]

(iii) Determine the magnitude of the net horizontal force that pulls the log along the ground.

net force = ……[1]

(iv) The mass of the log is 950 kg. Determine the acceleration of the log.

acceleration = ……[2]

End of Paper