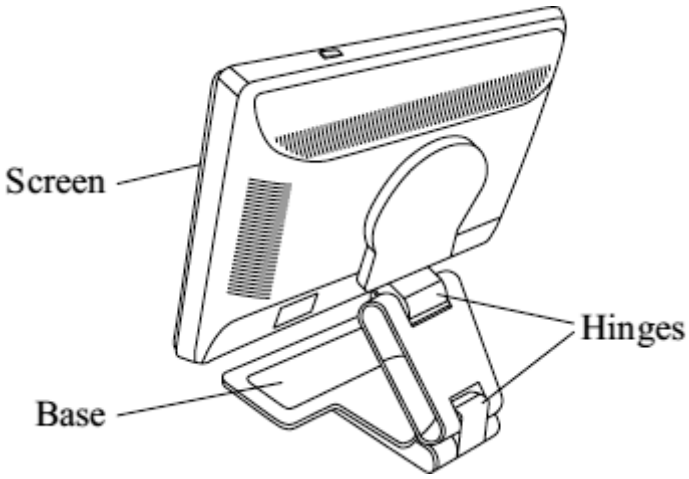
Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

The diagram shows a back view of a computer monitor.



(a) In normal use, the monitor is *stable*.

(i) Explain the meaning, in the above sentence, of the word *stable*.

_____

_____

_____

_____

(2)

(ii) State the relationship between the total clockwise moment and the total anticlockwise moment about any axis of the monitor when it is stable.

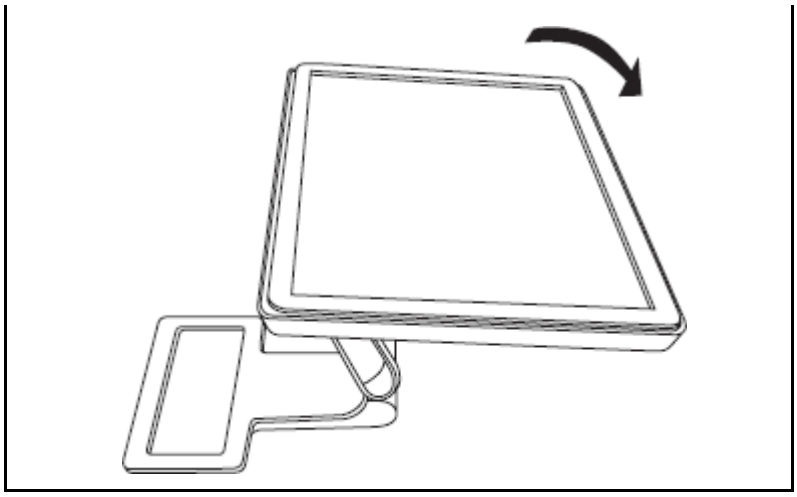
_____

_____

(1)

(b) The instruction booklet explains that the screen can be tilted.
It also includes a warning.

Caution
The monitor can tip over if the screen is tilted too far back.



Explain why the monitor will tip over if the screen is tilted too far back.

Include the words *centre of mass, weight* and *moment* in your explanation.

_____

_____

_____

_____

_____

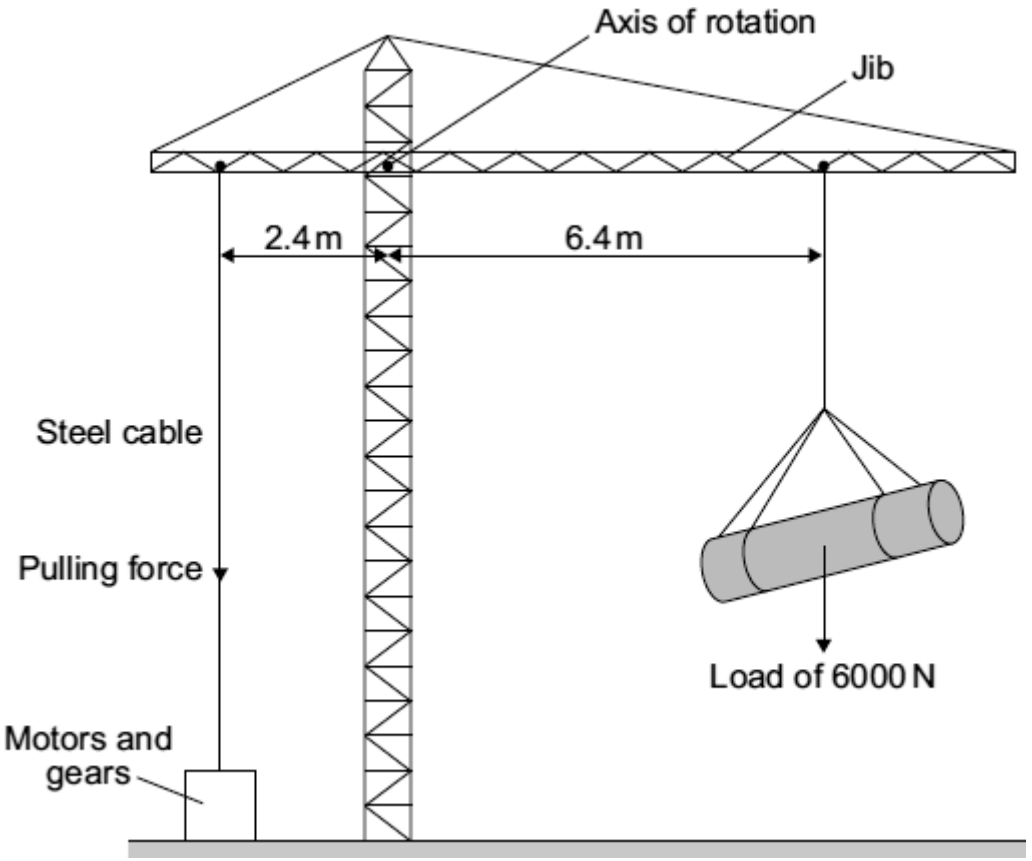
_____

(3)

(Total 6 marks)

Q2.

The diagram shows a design for a crane. The crane is controlled by a computer.



The purpose of the motors and gears is to change the pulling force in the steel cable.
This is done so that the jib stays horizontal whatever the size of the load or the position of the load.

(a) Calculate the moment caused by the load in the position shown in the diagram.

Show clearly how you work out your answer and give the unit.

_____

_____

Moment = _____

(3)

(b) Calculate the pulling force that is needed in the steel cable to keep the jib horizontal.

Show clearly how you work out your answer.

_____

_____

Pulling force = _____ N

(2)

(Total 5 marks)

Q3.

The diagram shows a child on a playground swing.
The playground has a rubber safety surface.

(a) The child, with a mass of 35 kg, falls off the swing and hits the ground at a speed of 6 m/s.

(i) Calculate the momentum of the child as it hits the ground.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

Momentum = _____

(3)

(ii) After hitting the ground, the child slows down and stops in 0.25 s.
Use the equation in the box to calculate the force exerted by the ground on the child.

$$\text{force} = \frac{\text{change in momentum}}{\text{time taken for the change}}$$

Show clearly how you work out your answer.

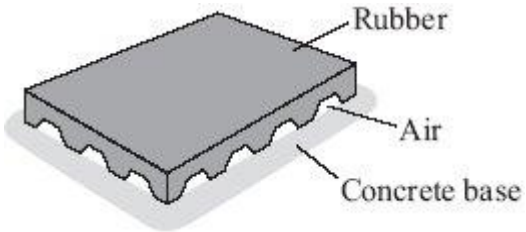
_____

_____

Force = _____ N

(2)

(b) The diagram shows the type of rubber tile used to cover the playground surface.



Explain how the rubber tiles reduce the risk of children being seriously injured when they fall off the playground equipment.

_____

_____

_____

_____

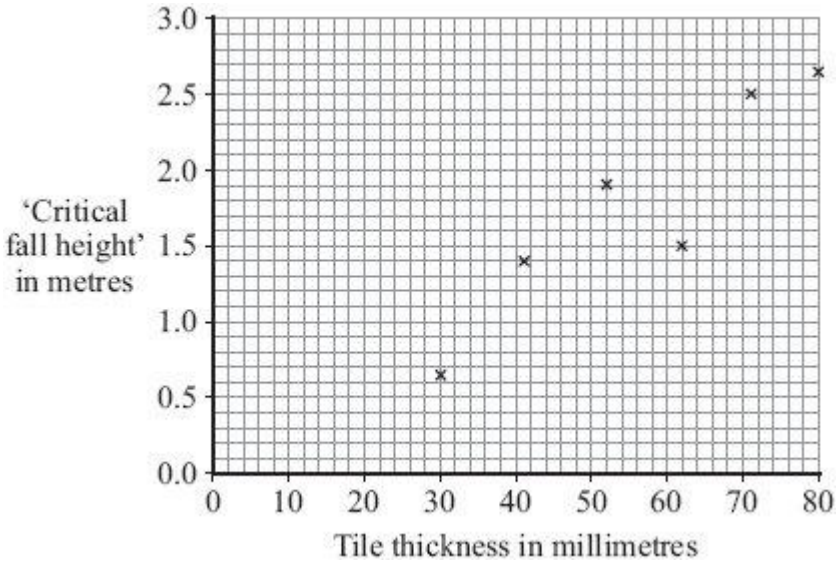
_____

_____

(3)

(c) The 'critical fall height' is the height that a child can fall and **not** be expected to sustain a life-threatening head injury.
A new type of tile, made in a range of different thicknesses, was tested in a laboratory using test dummies and the 'critical fall height' measured. Only one test was completed on each tile.

The results are shown in the graph.



The 'critical fall height' for playground equipment varies from 0.5 m to 3.0 m.

Suggest **two** reasons why more tests are needed before this new type of tile can be used in a playground.

1. _____

_____

2. _____

_____

(2)

(d) Developments in technology allow manufacturers to make rubber tiles from scrap car tyres.

Suggest why this process may benefit the environment.

_____

_____

(1)

(Total 11 marks)