

Physics 3AB - Year 12

Motion & Forces Test Two 2015

Name:

Mark: / 55
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Time Allowed: 50.0 Minutes

Notes to Students:

1. You must include **all** working to be awarded full marks for a question.
2. Marks will be deducted for incorrect or absent units and answers stated to an incorrect number of significant figures.
3. **No** graphics calculators are permitted – scientific calculators only.

Question 1**(6 marks)**

The pictures below show a famous scientist and a cartoon character riding a bicycle.



Picture 1



Picture 2

- (a) Calculate the magnitude of the torque when the scientist in Picture 1 exerts a force of 50.0 N downwards on the front pedal of the bicycle if it is a distance of 30.0 cm from the axle when the pedals are in a horizontal line.

(3 marks)

- (b) The same force is applied when the pedals are in a vertical line, as shown in picture 2. State the magnitude of the torque in this position.

(1 mark)

- (c) Explain your reasoning for your answer to part (b).

(2 marks)

Question 2**(5 marks)**

The picture below shows a design of a high chair used for feeding young children. Toddlers can be very vigorous and excitable at mealtimes so it is important that the design is stable.



- (a) State two features of the high chair that have an effect on its stability, and explain how each feature affects the stability of the chair.

(4 marks)

- (b) If the design were changed so that the child could be sat in a higher position what other design change could be made to retain the original degree of stability of the chair.

(1 mark)

Question 3**(7 marks)**

The International Space Station has a mass of 4.50×10^5 kg and sits at an altitude of 3.40×10^5 m above the Earth's surface.

- (a) Calculate the gravitational force acting between the Space Station and the Earth.

(4 marks)

- (b) An astronaut on this space station feels weightless whilst the Space Station is in orbit about the Earth. Explain why this is the case.

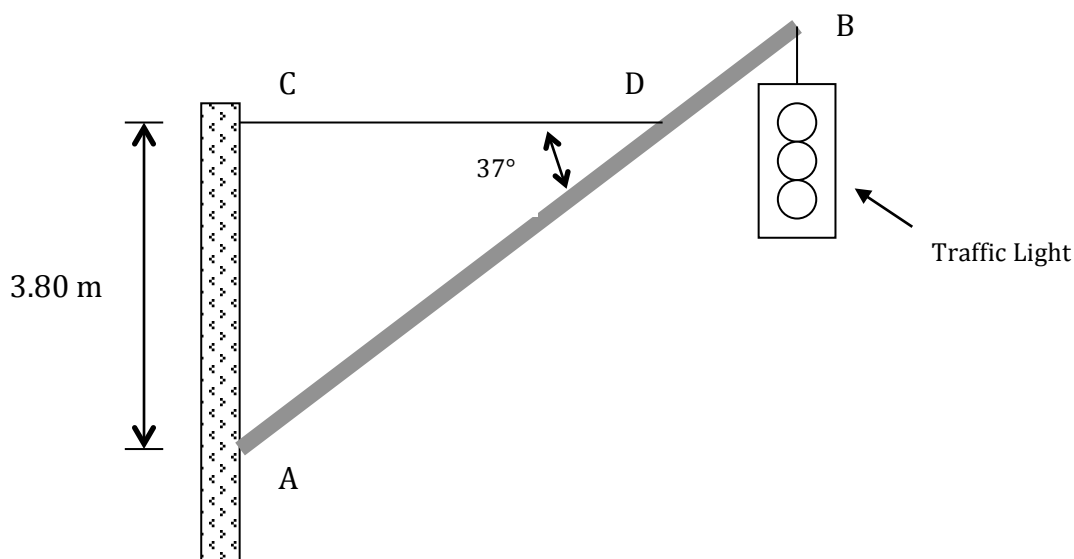
(3 marks)

Question 4**(6 marks)**

A window cleaner stands on a horizontal platform suspended at its ends by two vertical ropes A and B, which are 3.60 m apart. The platform is uniform and weighs 200 N. The tension in rope A is 600 N and in rope B is 350 N. Calculate where the window cleaner is standing on the platform.

Question 5**(5 marks)**

A traffic light hangs from a structure shown in the diagram below. The uniform aluminium pole AB is 7.50 m long and has a mass of 8.00 kg. The mass of the traffic light is 12.0 kg. The aluminium pole is attached to the vertical pole at point A and is supported by a massless, horizontal wire CD.



Calculate the magnitude of the tension in the wire CD.

Question 6**(12 marks)**

Jupiter is the largest planet in the Solar System and has many moons that orbit it. Jupiter has a radius of 7.78×10^7 m.

The data table below contains the orbital period and distance from Jupiter for four of its moons.

Moon	Orbital Period (days)	Distance from Jupiter between centre of masses (km)
Io	1.77	4.34×10^5
Europa	3.55	6.91×10^5
Ganymede	7.15	1.10×10^6
Calisto	16.7	1.94×10^6

- (a) Assuming a circular orbit, calculate the orbital speed of Calisto.
(4 marks)

- (b) Calculate the approximate mass of Jupiter using the data for Calisto.
(5 marks)

- (c) Calculate the gravitational field strength of Jupiter at Ganymede.
(3 marks)

- (c) In Position A the 8.00 m ladder makes a 50.0° angle with the ground and has a mass of 15.0 kg. Calculate the total force of the ground on the ladder.

(6 marks)

END OF TEST