A Level Physics

15th Mar 2021 – Circular Motion

Suitable for ALL exam boards

This session will look at a couple of old exam questions about circular motion.

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Question taken from:

OCR A Physics - January 2010 – G484 - Question 2

OCR A Physics - June 2010 – G484 - Question 2

2 **(a)** Fig. 2.1 shows the London Eye.

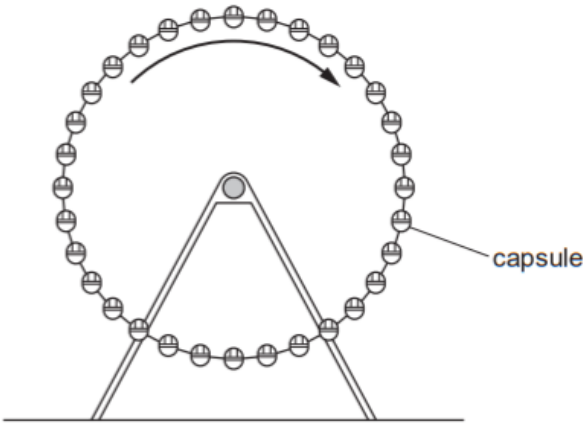

Fig. 2.1

It has 32 capsules equally spaced around the edge of a large vertical wheel of radius 60 m. The wheel rotates about a horizontal axis such that each capsule has a constant speed of $0.26\,m\,s^{-1}$.

(i) Calculate the time taken for the wheel to make one complete rotation.

time = ... s **[1]**

(ii) Each capsule has a mass of 9.7×10^3 kg. Calculate the centripetal force which must act on the capsule to make it rotate with the wheel.

centripetal force = ... N **[2]**

(b) Fig. 2.2 shows the drum of a spin-dryer as it rotates. A dry sock **S** is shown on the inside surface of the side of the rotating drum.

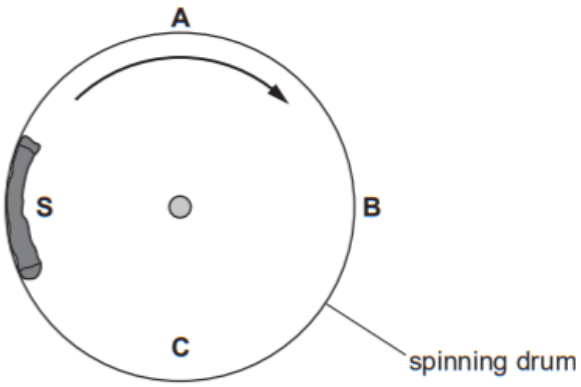

Fig. 2.2

(i) Draw arrows on Fig. 2.2 to show the direction of the centripetal force acting on **S** when it is at points **A**, **B** and **C**. **[1]**

(ii) State and explain at which position, **A**, **B** or **C** the normal contact force between the sock and the drum will be

1 the greatest

.....

.....

.....

..... **[2]**

2 the least.

.....

.....

..... **[1]**

[Total: 7]

2 **(a)** Fig. 2.1 shows an aeroplane flying in a horizontal circle at constant speed. The weight of the aeroplane is W and L is the lift force acting at right angles to the wings.

Fig. 2.1

(i) Explain how the lift force L maintains the aeroplane flying in a **horizontal** circle.

.....

.....

.....

..... **[2]**

(ii) The aeroplane of mass 1.2×10^5 kg is flying in a horizontal circle of radius 2.0 km.

The centripetal force acting on the aeroplane is 1.8×10^6 N. Calculate the speed of the aeroplane.

speed = ... $m\,s^{-1}$ **[2]**

(b) Fig. 2.2 shows a satellite orbiting the Earth at a constant speed v. The radius of the orbit is r.

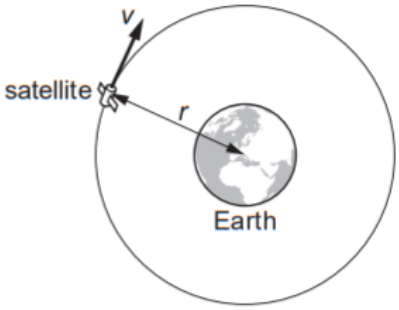

Fig. 2.2

Show that the orbital period T of the satellite is given by the equation

$$T^2 = \frac{4\pi^2 r^3}{GM}$$

where M is the mass of the Earth and G is the gravitational constant.

[3]

(c) The satellites used in television communication systems are usually placed in geostationary orbits.

In your answer, you should use appropriate technical words spelled correctly.

(i) State two features of geostationary orbits.

1. .....

.....

2. .....

..... **[2]**

(ii) Calculate the radius of orbit of a geostationary satellite.

The mass of the Earth is 6.0×10^{24} kg.

radius = ... m **[3]**

[Total: 12]