Full Name: …….. **Date: 23 November 2024**

Short Assessment

Time Allowed: 20 minutes **Total Marks: 19**

1.

(a) Fig. 2.1 shows the London Eye.

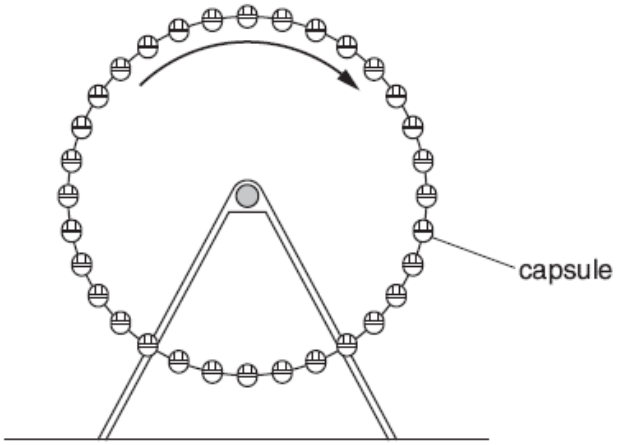

Fig. 2.1

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.

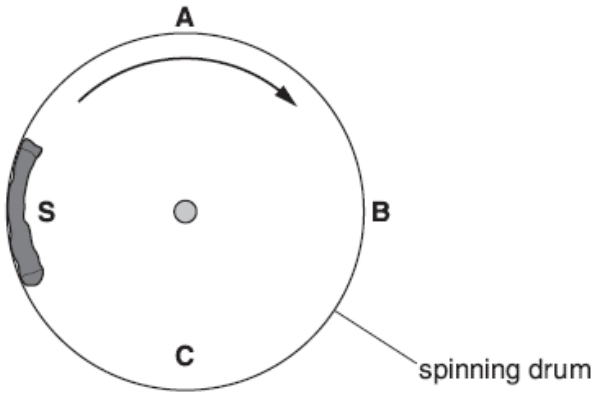

Fig. 2.2

(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]**

2.

(a) A jet plane on the deck of an aircraft carrier is accelerated before take-off using a catapult. The mass of the plane is 3.2×10^4 kg and it is accelerated from rest to a velocity of 55 m s^{-1} in a time of 2.2 s. Calculate

(i) the mean acceleration of the plane

mean acceleration = ... m s^{-2} **[2]**

(ii) the distance over which the acceleration takes place

distance = ... m **[2]**

(iii) the mean force producing the acceleration.

mean force = ...N **[1]**

(b) The jet plane describes a **horizontal** circle of radius 870 m flying at a constant speed of 120 $m s^{-1}$.

(i) State the direction of the resultant horizontal force acting on the plane.

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

(ii) Calculate the magnitude of this horizontal force.

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

(c) By changing the velocity of the plane it can be made to fly in a **vertical** circle of radius 1500 m. At a particular point in the vertical circle, the contact force between the pilot and his seat may be zero and the pilot experiences "weightlessness".

(i) State and explain at what point in the circle this weightlessness may occur.

.....

.....

.....

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

(ii) Calculate the speed of the plane at which weightlessness occurs.

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

- End of Test -