1 **(a)** A particular type of slide for children in a theme park is called a ‘drop slide’. This is a slide in which the first part of the fall is vertical. Fig.1.1 shows a child of mass 52 kg on a drop slide.

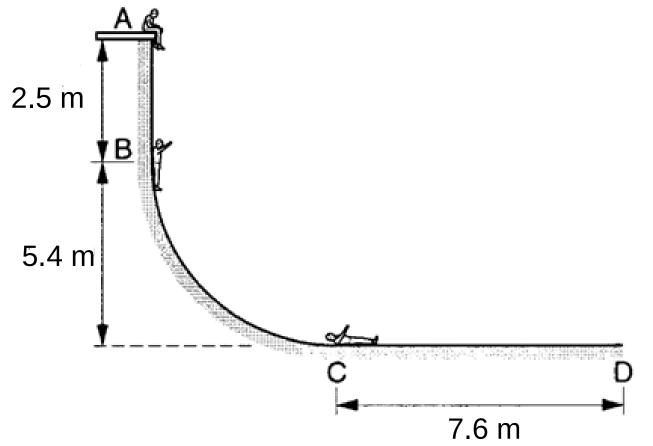

Fig.1.1 (not to scale)

The child drops from A, a distance of 2.5 m, before reaching the surface of the slide at B. There is no resistive force from A to B.

He then travels down a bend from B to C, while falling a further vertical distance of 5.4 m. At C, the child’s speed is the same as it was at B.

After this, the child travels 7.6 m horizontally before stopping at D.

(i) Determine the speed of the child at C.

speed = ………………… m s^{-1} [2]

(ii) The speed is the same at B and C.

Describe the energy changes from A to B to C.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

…………………………………………………………………………………………………… [2]

(iii) Calculate the average frictional force slowing the man between C and D.

force = ……………… N [2]

(b) Fig.1.2 shows a 'swing ride' in a carousel, where a man sitting on the rotating swing tilts away from the axis of rotation.

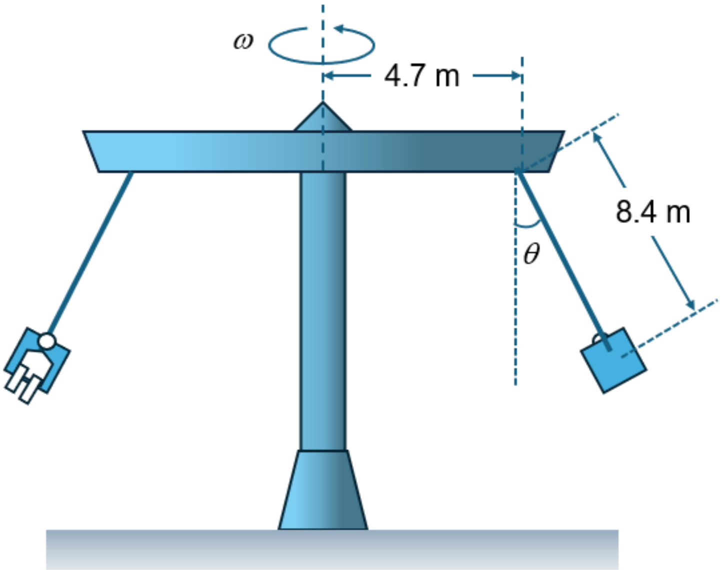

Fig. 1.2 (not to scale)

(i) Explain why the supporting cable holding the chair tilts as the carousel rotates.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………… [2]

(ii) Treat the man and his seat as one entity. Draw and label all the forces acting on it in Fig. 1.3 as the carousel rotates with a constant angular speed.

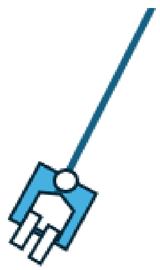

Fig. 1.3

[1]

(iii) Calculate the necessary angular speed ω for the swings to assume an angle $\theta = 35^{\circ}$ with the vertical.

angular speed = ... rad s^{-1} [3]

[Total: 12]