4 The Earth may be assumed to be a uniform sphere of radius 6400 km and mass *M*. At its surface the gravitational field strength is 9.81 N kg^{-1}. The gravitational field above the surface is the same as that due to a point mass *M* situated at the centre of the Earth.

(a) **(i)** Define *gravitational field strength*.

……

……

……[1]

(ii) Show that the mass of the Earth is 6.02×10^{24} kg. Show your workings clearly.

[2]

(b) A 50.0 kg boy is standing still on a flat ground located at latitude 35.6° north of the Equator, somewhere in Japan, as shown in Fig 4.1.

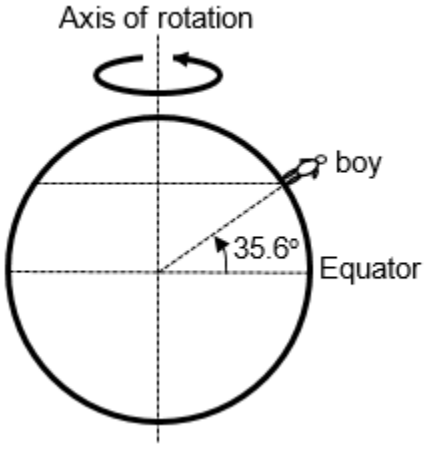

Fig. 4.1

(i) **1.** On Fig. 4.1, draw an arrow to indicate the direction of the centripetal force on the boy. [1]

2. Determine the centripetal force on the boy due to the rotation of the Earth.

centripetal force = …… N [2]

(ii) Draw and label all the forces acting on the boy on Fig. 4.2.

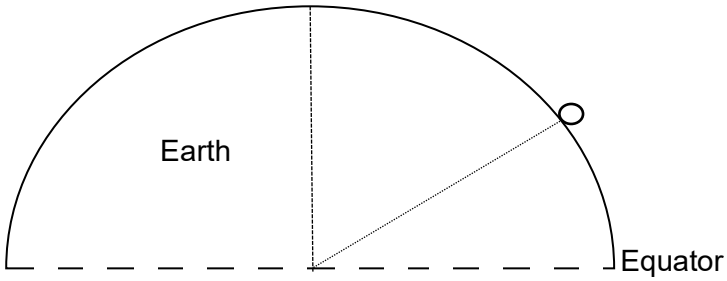

Fig. 4.2 (not drawn to scale) [2]

(iii) The boy now puts a weighing scale under him to read his weight from the scale at latitude 35.6° north of the Equator.

If the boy stands on the same weighing scale at the North pole, explain why the reading on the weighing scale is higher than that at latitude 35.6° north of the Equator.

……

……

……

……..……..……..[2]

[Total: 10]