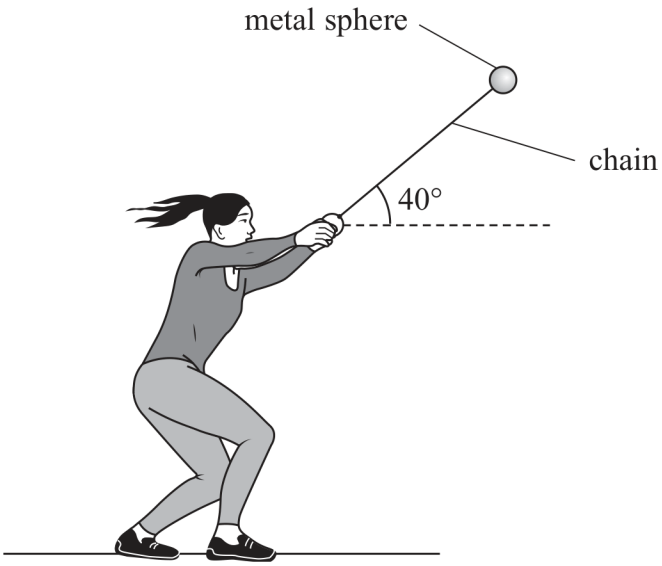
17 Hammer throwing is an Olympic sport. A hammer is a metal sphere attached to a chain. An athlete holds the chain and spins around so that the sphere moves in a circle. The chain is inclined at 40° to the horizontal, as shown.



(a) (i) The tension in the chain, acting on the sphere, is T.

Draw the free-body force diagram for the sphere at the position shown in the diagram.

(2)

(ii) Explain why the sphere moves with circular motion.

(2)

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.....

.....

.....

(iii) The sphere completes 2.8 revolutions per second.

Calculate the acceleration of the sphere.

distance from sphere to centre of circle = 1.5 m

(3)

Acceleration = ...

(b) The athlete finally releases the sphere with a velocity of 28 m s^{-1} at an angle of 40° to the horizontal. She releases the sphere at a height of 1.5 m above the ground.

The women's Olympic record distance for the hammer throw is 83 m.

Deduce whether this throw would break the record.

(5)

(Total for Question 17 = 12 marks)