1 At a training centre, a ski jumper takes off from a ramp. The end of the ramp is 1.0 m above the ground and is at an angle of 10° above horizontal as shown in Fig. 1.1. The ski jumper took 0.80 s, after leaving the ramp, to land on the ground. The air resistance is assumed to be negligible.

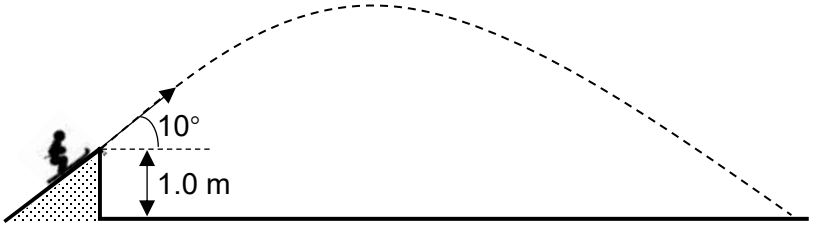

Fig. 1.1

(a) Show that magnitude of the vertical component of the velocity is 2.67 m s^{-1} when the ski jumper just leaves the ramp.

[1]

(b) Calculate the ski jumper's horizontal component of velocity as she leaves the ramp.

horizontal component of velocity = …… m s^{-1} [2]

(c) The measurement of time of flight 0.80 s was found to have an uncertainty of 0.08 s. In addition, a 5% uncertainty was found in the horizontal velocity in **(b)**.

Calculate the horizontal distance of the flight together with its uncertainty.

horizontal distance of flight = …….± ……. m [3]

(d) In real life, the effect of air resistance is not negligible.

(i) Explain the effect of air resistance on the vertical acceleration of the ski jumper from the moment she leaves the ramp until the highest point of the motion.

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……..……..

……..……..

……..…… [3]

(ii) It was observed that during the initial part of her flight, an Olympic ski jumper would lean forward in a V-shaped position, as shown in Fig. 1.2.

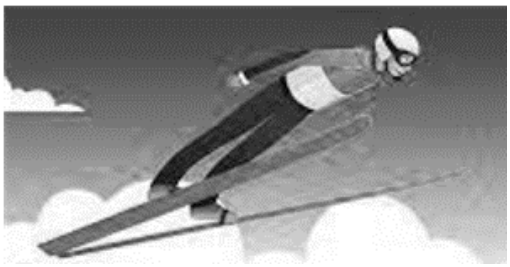

Fig. 1.2

Suggest why she could reach a further distance by adopting such posture.

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……..…… [1]