Motion in a uniform gravitational field with air resistance

1. A sphere is released from a certain height in the presence of air resistance (figure 1).

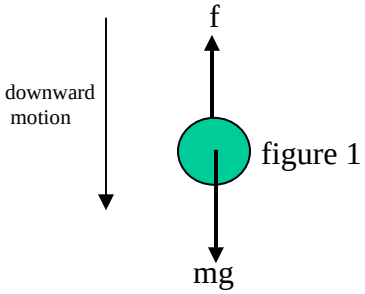

figure 1

(i) What is the initial speed of the sphere? Justify your answer.

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(ii) Given that air resistance causes an upward acceleration a_f on the sphere, write down the net acceleration of the sphere.

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(iii) State the direction of the net acceleration of the sphere.

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(iv) Using the equation of motion, $v = u + at_d$, write down the mathematical formula of the time taken, t_d, for the sphere to reach ground, taking 'a' to be the net acceleration.

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2. The same sphere is now thrown vertically upwards with initial velocity v (figure 2).

(i) What is the final velocity of the sphere? Justify your answer.

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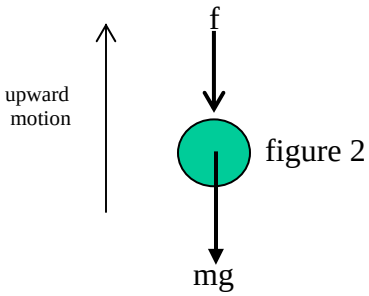

figure 2

(ii) Taking the acceleration due to frictional force to be a_f, write down the net acceleration of the sphere.

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(iii) State the direction of the net acceleration. Justify your answer.

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(iv) Using the equation of motion, $v = u + at_u$, write down the mathematical formula of the time taken, t_u, for the sphere to reach maximum height, taking 'a' to be the net acceleration.

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(v) Comment on your answers to No. 1 (iv) and No. 2 (iv).

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3. What will be the time t_d and t_u in the absence of air resistance? Justify your answer.

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