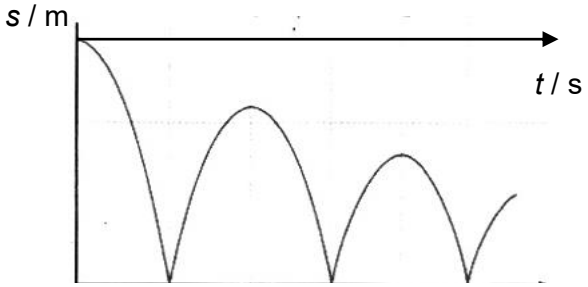
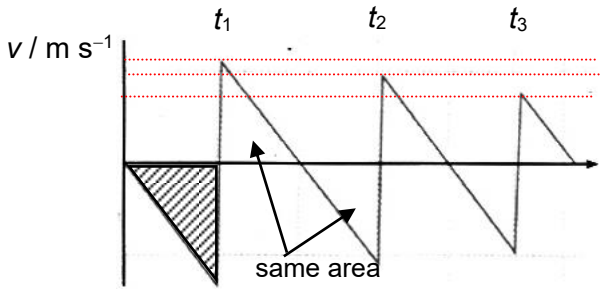
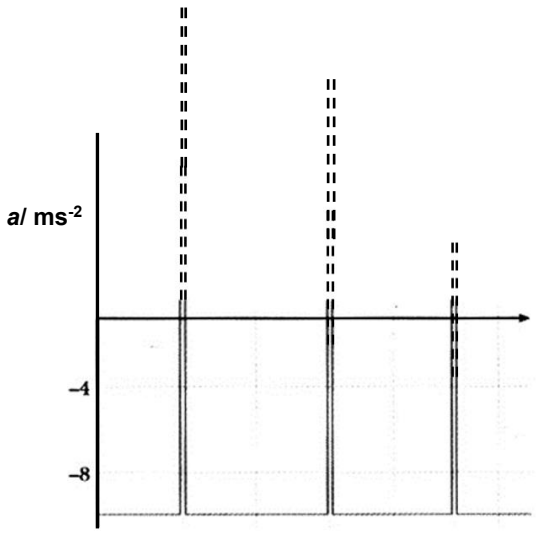
JURONG PIONEER JUNIOR COLLEGE
9478 H2 PHYSICS/8867 H1 PHYSICS

MOTION AND FORCES ASSIGNMENT SOLUTIONS

Qn.	Solution	Mark Allocation
1(a)	   <u>Displacement-time graph</u> Due to energy loss on hitting the floor, the maximum height to which the ball rises decreases with each bounce. <u>Velocity-time graph</u> The velocity of the ball is negative on its downward motion, positive on its upward motion, and is zero momentarily at maximum height after each bounce.	[1] for correct shape of graph [1] for correct shape of graph (i.e. saw-tooth with decreasing height) [1] for same area for adjacent triangles in the same bounce [1] for correct shape of graph [1] for horizontal straight line at −9.81

	<u>Acceleration-time graph</u> The graph is mainly a horizontal straight line for most parts of the motion where the ball is in free-fall. This acceleration of free fall is directed downwards, hence it is negative. However, upon impact with the floor, the change in direction of motion of ball within a short time interval causes the ball to experience a large acceleration directed upwards and is hence positive, which appear as the spikes (i.e. assumed that rebound happened immediately upon impact, and impact time → 0).	
1(b)	The initial height of the ball, which is the magnitude of the displacement prior to the first bounce, can be found from the area under the velocity-time graph (refer to the shaded region).	[1] for correct description

2 **(a)** Momentum of the ball,

$p = mv$

$= 0.16 \times 35$ [1]

$= 5.6$ kg m s^{-1} (to the left)

(b) **(i)** Change in momentum

$\Delta p = \frac{1}{2}(280)(0.12 - 0.04)$ [1]

$= 11.2$ kg m s^{-1} [1]

(ii) Average force $\langle F \rangle = \frac{\Delta p}{\Delta t} = \frac{11.2}{0.12 - 0.04} = 140$ N [1]

(iii) The ball approaches the racket from the right. Take rightward as positive:

$\Delta p = m\Delta v$

$11.2 = 0.16\left[v_f - (-35)\right]$ [1]

$v_f = 35$ m s^{-1} [1]