Higher Equations of Motion Answers

1. a) **$v = u + at$**, **$v^2 = u^2 + 2as$** and **$s = ut + \frac{1}{2}at^2$**.

b) u - initial velocity (ms^{-1}), v - final velocity (ms^{-1}),
a - acceleration (ms^{-2}), s - displacement (m) and t - time (s).

2. v = 21.2ms^{-1}.

3. s = 62.5m.

4. s = 49.6m.

5. a) **Acceleration** is the **change in velocity** per **unit** of **time**.

b)

1. The trolley is released at the top of the ramp from rest.
2. The piece of card on top of the trolley will then break the beam of light in light gate 1.
3. The initial velocity of the trolley can be worked out from $u = d/t_1$ = length of card/time on timer 1.
4. When the card breaks the second light beam, the final velocity can be found from $v = d/t_2$ = length of card/time on timer 2.
5. A metre ruler is then used to measure the displacement s between the 2 light gates.

From **$v^2 = u^2 + 2as$, then $a = (v^2 - u^2)/2as$.**

6. a) v = 19.6ms^{-1}.

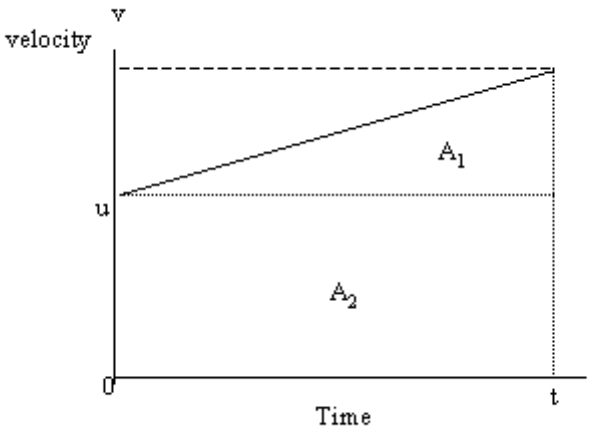
b) s = 93.7m.

7. The object will increase its **velocity** by 4ms^{-1} **every second**.

8. a) OP -> Constant velocity

PQ -> Stationary.

9.



The displacement(s) is equal to the total area = (A_1+A_1) under the graph.

$s = A_1+A_1$

$$s = ut + \frac{(v-u) \times t}{2}$$

Note that from the definition of acceleration:

$$a = \frac{(v-u)}{t}$$

⇨ (v-u)= at

Substitute this into the expression above.

$$s = ut + \frac{at \times t}{2}$$

$$s = ut + \frac{at^2}{2}$$

$s = ut + ½ at^2$.

10. a) i) s_1 = 0.2m.
ii) s_2 = 1.8m and so Δs = 1.6m.
iii) a = 8.9ms^{-2}.

b) i) + ii) a = (8.8 ± 0.1)ms^{-2}.

c) The **contact time is greater** with a smaller material.

The **rebound height will be less** because the sponge will absorb more of the balls kinetic energy.

The reduced rebound height can also be explained as a result of the average upward force exerted by the sponge on the ball being less.

11. a) The time for both sprinters is 5 Seconds.

b) $\mathbf{V_p} = 8ms^{-1}$ and $\mathbf{V_Q} = 6ms^{-1}$.

c) The distance between the starting points = 5m.

12. a) s = 42m.

b) Speed at Q is greater.
Mass of the car is greater.
Deceleration is less since **a = F/m** with F being a constant.

OR You will get the full marks by showing a full calculation.

c) i) Electrons and holes recombine at the junction and energy is released in the form of photons of light.

ii) R = 15.9Ω.