KINEMATICS

TUTORIAL ANSWERS

1.) Let v_y be the vertical velocity of the projectile, then

$\tan \theta = v_y / v = (\sqrt{2gh}) / v$

Value of $\tan \theta$ is the largest if h is the largest and v is the smallest. **So B is the answer.**

2.) $s = 1/2gt^2$

Where g is the uniform acceleration of the body, thus displacement increases at a increasing rate with respect to time, t.

Body starts from rest. Thus, the slope is zero at start. **So B is the best answer.**

3.) $s_y = u_y t + 1/2gt^2$ since $u_y = 0$, thus

$s_y = 1/2gt^2$ only.

$1.25 = \frac{1}{2}(9.81)(t)^2$, t = 0.5 s.

$s_x = u_x t$, $u_x = s_x / t = 10 / 0.5 = $ **20 ms^{-1}**

4.) For such a projectory path described by a stone thrown into the air, the vertical component of the acceleration is always the acceleration of free fall, g taken as 9.81 ms^{-2} , towards the centre of Earth. Thus, vertical component of acceleration at point P is the same as that at point T and is equal to g. **Answer is D.**

5.) Overall average speed of the car is $= \dfrac{total\ distance\ travelled}{total\ time\ taken} = \dfrac{(20\ x\ 2.0)+(40\ x\ 2.0)+(60\ x\ 6.0)}{(2.0+2.0+\ 6.0)}$

$= $ **48 ms^{-1}**

6.) Area under graph = ½ (0.8)(2.5) = **1.0 m**

7.) Value of the velocity-time graph is the gradient of displacement-time graph.

First part of the graph shows value of velocity is becoming more and more positive.

Thus gradient of displacement-time graph must be more and more positive too.

Second part of the graph shows value of velocity is constant positive.

Thus gradient of displacement-time graph must be constant positive too.

Third part of the graph shows value of velocity is becoming less and less positive.
Thus gradient of displacement-time graph must be less and less positive too.
Answer is C.

7.) The value of velocity is given by the gradient of the displacement-time graph.

Answer is C.

8.) At maximum height, velocity of the ball is zero. **Answer is D.**

Point B cannot be the answer even though the velocity is zero because it is the point where the ball hits the ground, not highest point.

9.) $v^2 = u^2 + 2as$

$20^2 = 10^2 + 2(a)(100)$

a = 1.5 ms^{-2}