Answer on Question #56262 – Physics/Mechanics – Relativity

18. Condition: a boy throws a ball vertically upward with a speed of 15.0m/s. What is its speed just before the boy catches it again?

Solution: due to energy saving law, kinetic energy will be exactly the same in the end, as it was at was at the beginning, thus the absolute value of speed will be the same, but direction will be opposing.

Answer: 15.0 m/s downward.

19. Condition: a ball is thrown vertically upward with a speed v from a point h meters above the ground. What is the time taken for the ball to strike the ground?

Solution:

$$t_{total} = t_{up} + t_{down}$$

$$g \cdot t_{up} = v; t_{up} = \frac{v}{g};$$

$$h_{total} = h + v \cdot t_{up} - \frac{g \cdot t_{up}^2}{2} = h + \frac{v^2}{g} - \frac{v^2}{2 \cdot g} = h + \frac{v^2}{2 \cdot g}$$

$$h_{total} = \frac{g \cdot t_{down}^2}{2}; t_{down}^2 = 2 \cdot \frac{h_{total}}{g} = 2 \cdot \left(\frac{h}{g} + \frac{v^2}{2 \cdot g^2}\right)$$

$$t_{down} = \frac{\sqrt{2gh + v^2}}{g}$$

Answer: $\boldsymbol{t = \frac{\sqrt{2gh+v^2}}{g}}$

20. Condition: a body moves along the x-axis according to the law x=2t3+5t2+5, where x is in metres. Find the acceleration at t=3s.

Solution: for $x = f(t)$, acceleration should be found as $\frac{\partial^2 f(t)}{\partial x^2} = \frac{\partial^2}{\partial x^2}(2 \cdot t^3 + 5 \cdot t^2 + 5) = 12t + 10 = |at\ t = 3| = 46\frac{m}{s}$.

Answer: $\boldsymbol{46\frac{m}{s}}$**.**