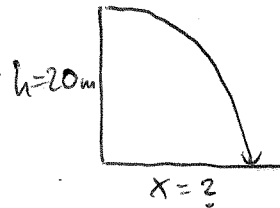


1. A girl throws a rock horizontally, with a velocity of 10 m/s, from a bridge. It falls 20 m to the water below. How far does the rock travel horizontally before striking the water? (take $g = 10 \text{ m/s}^2$)

- a) 14 m
b) 16 m
c) 20 m
d) 24 m
e) 26 m

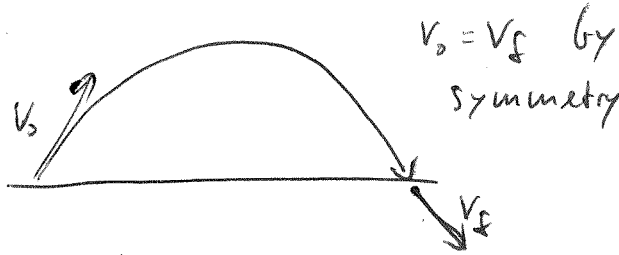


$$h = \frac{1}{2} g t^2 \quad t = \sqrt{\frac{2h}{g}} = 2 \text{ s}$$

$$x = v_x t = 20 \text{ m}$$

2. An arrow is shot from a bow, at an original speed of v_0 . Neglect air resistance. When it returns to the same original level its speed will be

- a) $v_0/2$
b) v_0
c) $2v_0$
d) $9.8v_0$
e) $4.9v_0$



3. A car travelling at 30 miles/hour is able to stop in a distance d . Assuming the same braking force, what distance does this car require to stop when it is travelling twice as fast?

- a) d
b) $\sqrt{2}d$
c) $2d$
d) $4d$
e) none of the other answers

$$0^2 - v_i^2 = 2ad \quad d = -\frac{v_0^2}{2a}$$

$$d_2 = -\frac{(2v_0)^2}{2a} = -4 \frac{v_0^2}{2a} = 4d$$

4. A stone is thrown vertically upwards from the ground. What statement is true during its flight?

- a) its velocity is always positive
b) its acceleration is always downwards
c) its acceleration is zero at the highest point reached
d) its velocity is never zero
e) its acceleration is different on its upward and downward flight

5. A car decelerates uniformly and comes to a stop after 10 s. The car's average velocity during deceleration is 50 km/h. What is the car's deceleration while slowing down? (hs = hour second)

- a) 12 km/hs
b) 10 km/hs
c) 8 km/hs
d) 5 km/hs
e) 4 km/hs

$$v_{avg} = \frac{v_f + v_i}{2} = \frac{0 + v_i}{2} = \frac{v_i}{2}$$

$$v_i = 2v_{avg} \quad a = \frac{v_f - v_i}{\Delta t}$$

$$a = \frac{0 - 2v_{avg}}{\Delta t} = -10 \text{ km/hs}$$

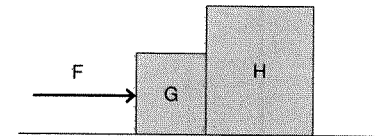
6. A child's toy is suspended from the ceiling by means of a string. The earth pulls downward on the toy with its weight force of 8 N. If this is the action force, what is the reaction force?

- a) the string pulling upward on the toy with an 8 N force
b) the ceiling pulling upward on the string with an 8 N force
c) the string pulling downwards on the ceiling with an 8 N force
d) the toy pulling upward on the earth with an 8 N force
e) none of the other answers

Newton's 3rd Law

7. Two cardboard boxes full of books are in contact with each other on a frictionless surface. Box H has twice the mass of box G. If you push on box G with horizontal F , causing the boxes to slide across the surface with acceleration a , then box H will experience a net force of

- a) $(2/3) F$
b) F
c) $(3/2) F$
d) $2 F$
e) insufficient information



$$\left. \begin{aligned} F &= 3m a \\ F_H &= 2m a \end{aligned} \right\} \Rightarrow F_H = \frac{2}{3} F$$

8. During the investigation of a traffic accident, the police find skid marks 90 m long. They determine the coefficient of friction between the car's tires and the roadway to be 0.5 for the prevailing conditions. Estimate the speed of the car when the brakes were applied. ($g = 9.8 \text{ m/s}^2$)

- a) 19.6 m/s
 b) 24.1 m/s
 c) 26.2 m/s
 d) 29.7 m/s
 e) 33.1 m/s

$$F_f = -\mu_k mg = ma$$

$$a = -\mu_k g$$

$$v_f^2 - v_i^2 = 2ad \quad 0^2 - v_i^2 = -2\mu_k g d$$

$$v_i = \sqrt{2\mu_k g d} = 29.7 \text{ m/s}$$

9. Trudie, whose mass is 60 kg, stands on a bathroom scale in an elevator at rest. What will the scale read when the elevator is accelerating upward at 4.0 m/s^2 ? ($g = 10 \text{ m/s}^2$)

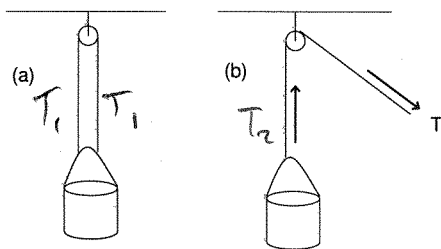
- a) 240 N
 b) 600 N
 c) 940 N
 d) 360 N
 e) none of the other answers

$$F_N - mg = ma$$

$$F_N = m(a+g) = 840 \text{ N}$$

10. Part a) of the drawing shows a bucket of water suspended from the pulley of a well. The tension in the rope is 100N. Part b) shows the same bucket of water being pulled up from the well at constant velocity. What is the tension T in the rope in part b.

- a) < 100 N
 b) 100 N
 c) $100 \text{ N} < T < 200 \text{ N}$
 d) 200 N
 e) insufficient information



$$2T_1 = mg$$

$$mg = 200 \text{ N}$$

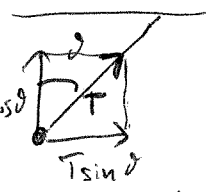
$$T_2 = mg = 200 \text{ N}$$

11. If you blow up a balloon, and then release it, the balloon will fly away as the air rushes out. This is an illustration of

- a) Newton's First Law
 b) Newton's Second Law
 c) Newton's Third Law
 d) Galileo's Law of Inertia
 e) Newton's Law of Universal Gravitation

12. A block is hung by a string from the inside roof of a van. When the van goes straight ahead at a speed of 28 m/s, the block hangs vertically down. But when the van maintains this same speed around an unbanked curve (radius = 150 m), the string makes an angle θ with the vertical. Find θ . ($g = 9.8 \text{ m/s}^2$)

- a) 30°
 b) 22°
 c) 32°
 d) 24°
 e) 28°



$$T \sin \theta = \frac{mv^2}{r}$$

$$T \cos \theta = mg$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{v^2}{gr} = 0.533$$

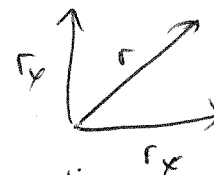
13. A car travels at a constant speed around a circular track whose radius is 2.6 km. The car goes once around the track in 360s. What is the magnitude of the centripetal acceleration of the car?

- a) 1.84
 b) 0.79
 c) 0.50
 d) 0.25
 e) 0.98

$$a_c = \frac{v^2}{r} = \left(\frac{2\pi r}{T}\right)^2 \frac{1}{r} = \frac{4\pi^2 r}{T^2} = 0.79 \text{ m/s}^2$$

14. The displacement vector \vec{r} in the x - y plane has a magnitude of $r = 175 \text{ m}$ and points at an angle of 50° relative to the x -axis. What are the x and y components of this vector, respectively?

- a) 117m, 152m
 b) 134m, 112m
 c) 112m, 134m
 d) 152m, 117m
 e) insufficient information



$$r_x = r \cos \theta = 112 \text{ m}$$

$$r_y = r \sin \theta = 134 \text{ m}$$

15. The engine of a boat drives it across a river that is 1800 m wide. The velocity \vec{v}_{BW} of the boat relative to the water is 4 m/s directed perpendicular to the current. The velocity \vec{v}_{WS} of the water relative to the shore is 2 m/s. The time t for the boat to cross the river, and the speed v_{BS} of the boat relative to the shore are

- a) 510 s, 4 m/s
- b) 450 s, 4.5 m/s
- c) 510 s, 6 m/s
- d) none of the other answers
- e) 450 s, 4.5 m/s

either
answe
correct!

$$t = \frac{1800 \text{ m}}{v_{BW}} = 450 \text{ s}$$

$$v_{BS} = \sqrt{v_{BW}^2 + v_{WS}^2} = 4.5 \text{ m/s}$$

