Key

Physics Review 1st semester

Vocabulary:

speed

acceleration

friction

inertia

mass

weight

scalar

vector

momentum

displacement

1. Suppose you take a trip that covers 120 km in 3 hours. Your average speed is?

$s = \frac{d}{t}$ $\frac{120\text{km}}{3\text{hr}}$ = 40 km/hr

2. What is the car's acceleration if after 20 seconds from rest the car is moving at 60 m/s.

$a = \frac{\Delta v}{t}$ $\frac{60-0}{20}$ = 3 m/s/s

3. A car accelerates 4 m/s/s. Assuming the car starts from rest, how much time does it need to accelerate to a speed of 50 m/s/s?

$a = \frac{\Delta v}{t}$ $\quad 4\ m/s^2 = \frac{50-0}{t}$ $\quad \therefore 12.5\ sec.$

4. 20 seconds after starting from rest, a free falling object will have a speed of about?

$a = \frac{\Delta v}{t}$ $\quad 9.8 = \frac{v-0}{20}$

196 m/s²

5. How much does a 3 kg bag of nails weigh?

$w = mg$ $\quad w = (3\ kg)(9.8\ m/s^2)$

29.4 N

6. The mass of a cat that weights 50 N is about?

$w = mg$ $\quad 50\ N = (m)(9.8\ m/s^2)$

5.1 kg

7. A 20 N force and a 30 N force act on object in opposite directions. What is the net force on the object?

10 N in direction of 30 N force

8. How much force is needed to give a 3 kg book an acceleration of 8 m/s/s?

$f = ma$ $\quad f = (3\ kg)(8\ m/s^2)$ $\quad 24\ kg\ m/s^2$

24 N

9. A jumbo jet cruises at a constant velocity when the total thrust of the engines on the jet is 100,000 N. How much air resistance acts on the jet?

100,000 N

10. A car has a mass of 500 kg and accelerates at 3 m/s/s. What is the magnitude of the force acting on the car?

$F = ma$ $\quad f = (500\ kg)(3\ m/s^2)$ $\quad 1500\ N$

11. A 5 kg ball is thrown at 5 m/s. What is the ball's momentum?

$p = mv$ $\quad p = (5\text{kg})(5\text{m/s})$ $\quad 25\ \text{kg m/s}$

12. A 5 kg ball has a momentum of 10 kg m/s. What is the ball's speed?

$p = mv$ $\quad 10\ \text{kg m/s} = (5\text{kg})(v)$

$2\ \text{m/s}$

13. A ball is moving at 3 m/s and has a momentum of 24 kg m/s. what is the ball's mass?

$p = mv$ $\quad 24\ \text{kg m/s} = (m)(3\ \text{m/s})$

$8\ \text{kg}$

14. After 10 seconds a jogger's displacement is 100 m. What is the average velocity in m/s?

$v = \frac{d}{t}$ $\quad v = \frac{100}{10} = 10\ \text{m/s}$

15. What is the force required to accelerate a 10 kg bowling ball to an acceleration of 1.0 m/s/s?

$f = ma$

$f = (10\text{kg})(1.0\ \text{m/s}^2) = 10\ \text{N}$

16. Joe stands at the rim of the Grand Canyon and yodels down to the bottom. He hears his yodel back from the canyon floor 2.5 seconds later. Assume that the speed of sound in air is 340 m/s. How deep is the canyon at this location?

$d = r \cdot t$ $\quad d = (340\ \text{m/s})\left(\frac{2.5}{2}\right)$

$425\ \text{m}$

17. A car is traveling 10 m/s when a dog runs in front of the car. If it takes the driver 5 seconds to stop, what is the acceleration of the car?

$a = \frac{\Delta v}{t}$ $\quad a = \frac{0 - 10}{5}$ $\quad -2\ m/s^2$

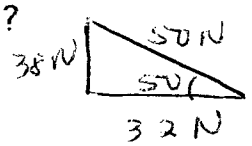
18. A car driving 30 m/s decides to pass a truck. If the car can accelerate 3 m/s/s, how long will it take for him to reach a speed of 50 m/s?

$3\ m/s/s = \frac{50 - 30}{t}$ $\quad$ 6.7 sec

19. Joe pulls his sister on a sled with a force of 50 N at an angle of 50 degrees to the horizontal. What are the horizontal and vertical components of the force exerted by Joe?

$\cos 50 = \frac{x}{50}$

$\sin 50 = \frac{y}{50}$



20. A Royals player swung at a 10 kg baseball and accelerated it at a rate of 2.5×10^4 m/s/s. How much force did the player exert on the ball?

$F = ma \quad F = (10kg)(2.5 \times 10^4\ m/s^2)$

$2.5 \times 10^5\ N$

21. Doug is trying to make a 30 kg dog go out the back door but the coefficient of friction between the dog and floor is 0. 30, how hard must Doug push in order to move the dog with a constant speed?

$F_f = \mu F_n \quad F_f = (0.30)(30kg)(9.8)$

$88.2\ N$

22. Sue his a .30 kg ball, giving it a speed of 25 m/s. What impulse does she impart to the ball?

$Impulse = F \cdot t = m \cdot v$

$(30kg)(25\ m/s) = 750\ N \cdot s$

23. Sally hits a stationary .25 kg puck with a force that lasts 2.0×10^{-3} seconds and makes the puck shoot across the ice with a speed of 10 m/s, scoring a goal for the team. With what force did Sally hit the puck?

$f \cdot t = m \cdot v$

$(f)(2.0 \times 10^{-3}) = (.25)(10)$ 1250 N

24. Running at 3.0 m/s, Anne the 30 kg catcher collides with Sue, the 35 kg runner, who is traveling at 6.0 m/s in the other direction. Upon collision, Sue continues to travel forward at 1.0 m/s. How fast is Anne knocked backwards?

$mv + Mv = mv + mv$

Anne $m = 30$ $v = 3.0$

Sue $m = 35$ $v = 6.0$

$m = 30$ $v =$

$m = 35$ $v = 1.0$

$(30)(3.0) + (35)(6) = 30V + (35)(1$

$-120 = 30V + 35$

-5.2 m/s

25. A ball is thrown has 2.0×10^3 J of potential energy when it reaches a height of 5 m. What is the mass of the ball?

$GPE = W \cdot h$

$2.0 \times 10^3 J = (m(9.8))(5)$

40.8 Kg

26. A greyhound at a race track can run at a speed of 16.0 m/s. What is the KE of a 20.0 kg greyhound as it crosses the finish line?

$KE = \frac{1}{2} m v^2$ $\frac{1}{2}(20.0)(16.0)^2$

2560 J

Also

$W = f \cdot d$

$P = \frac{W}{t}$

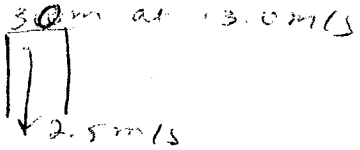
27. A coin rolls along the top of a 1.54 m high desk with a constant velocity. It reaches the edge of the desk and hits the ground 0.30 m from the edge of the desk. What was the velocity of the coin as it rolled across the desk?

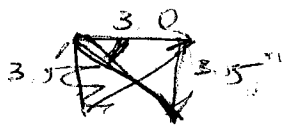
$d_x = v_x \cdot t$ $\quad .30 = v_x (.52)$ $\quad v = .53 \text{ m/s}$

$d_y = \frac{1}{2} g t^2$ $\quad 1.54 = (\frac{1}{2})(9.8) t^2$

$t = .52 \text{ s}$

28. Britt is traveling 3.0 m/s directly across a river that is 30 m wide. The current of the river is 2.5 m/s. How long will it take Britt to travel across the river? What is her resultant velocity? How far downstream will she end up?

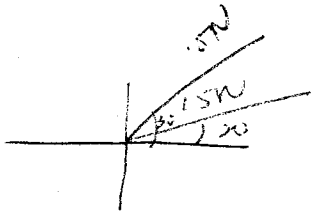


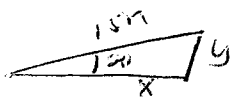


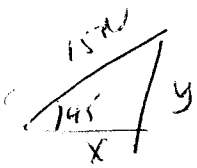
$a^2 + b^2 = c^2$ $\quad 3.9 \text{ m/s}$

$t = \frac{d}{r} = \frac{30}{3} = 10 \text{ s}$ $\quad 69^\circ$ S of E

29. If a force of 15 N is acting on an object at an angle of 20° and another force is acting on the same object at an angle of 45°, what force would be needed to make the object be in equilibrium?



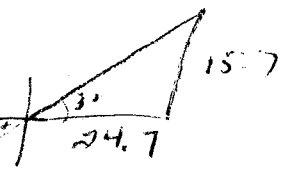




$\sin 45 = \frac{y}{15}$ $\quad y = 10.6$ $\quad y = 10.6$

$\sin 20 = \frac{y}{15}$ $\quad y = 5.1$

$\cos 20 = \frac{x}{15}$ $\quad x = 14.1$



$(10.6 + 5.1) = y$ $\quad 10.6 + 14.1 = x$

$\tan\theta = \frac{15.7}{24.7}$ $\quad 32.5$

$F = 29.3 \text{ N}$

at 212°