

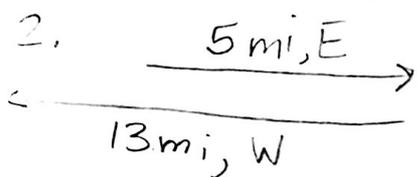
Fall Final Answer Key

1. B. Magnitude and Direction

magnitude means size or quantity

direction means which way its pointing

B



displacement means the distance between where I started and where I ended.

so, $13 - 5 = 8 \rightarrow$ C. 8 mi, W

C

3. Speed = $\frac{\text{distance}}{\text{time}}$

$d = 240 \text{ km}$

$t = 4 \text{ hr}$

$S = \frac{d}{t}$

\rightarrow

$S = \frac{240 \text{ km}}{4 \text{ hr}}$

C.
 $= 60 \text{ Km/hr}$

A

4. Since velocity doesn't change, the acceleration is zero because acceleration means change in velocity.

v	8	8	8	8	8	m/s
t	1	2	3	4	5	(in seconds)

A

5. $t = 10 \text{ s}$
 $V_i = 0 \text{ m/s}$ ← rest means it is not moving

$V_f = 40 \text{ m/s}$

$a = ?$

$a = \frac{V_f - V_i}{t}$

$a = \frac{40 - 0}{10}$

$a = \frac{40}{10}$
 $a = 4 \text{ m/s}^2$

C

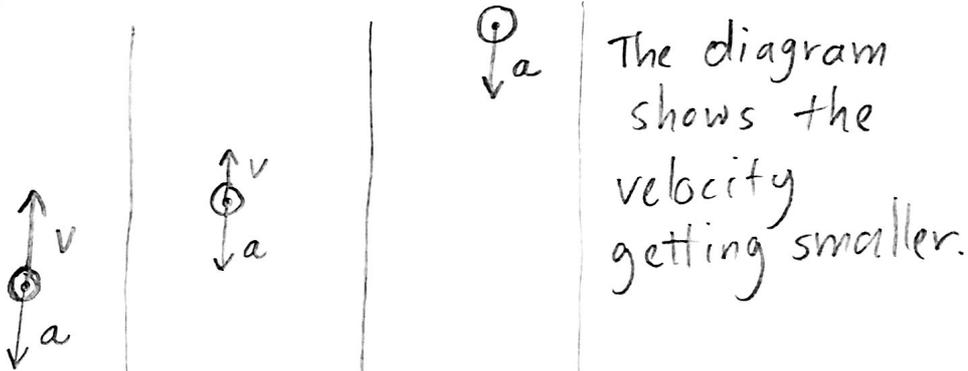
6. Acceleration on Earth is due to gravity and it equals 9.8 m/s^2 . This does not change. If you jump out an airplane, your speed does.

example: speed as you fall out the airplane

v	9.8	19.6	29.4	39.2	49	m/s
t	1	2	3	4	5	s

A

7. As an object reaches the top its velocity equals zero because the acceleration is pointing in the opposite which slows it down



A

8. $a = 2 \text{ m/s}^2$
 $V_i = 0 \text{ m/s}$
 $V_f = 30 \text{ m/s}$
 $t = ?$

$$a = \frac{V_f - V_i}{t}$$

$$2 = \frac{30 - 0}{t}$$

$$2 = \frac{30}{t}$$

$$t \cdot 2 = \frac{30}{t} \cdot t$$

$$2t = 30$$

$$\frac{2t}{2} = \frac{30}{2}$$

$$t = 15 \text{ s}$$

B

9. $t = 10s$ $a = 9.8 m/s^2$

$V_i = 0 m/s$

$V_f = ?$

any object in free fall, falls at the acceleration due to gravity of the Earth.

$$a = \frac{V_f - V_i}{t} \rightarrow 9.8 = \frac{V_f - 0}{10}$$

$$9.8 \cdot 10 = \frac{V_f}{10} \cdot 10$$

$$98 = V_f \rightarrow \text{so, } 98 \sim 100$$

(about) approximately

C

10. The horizontal and vertical components are independent (do not affect each other).

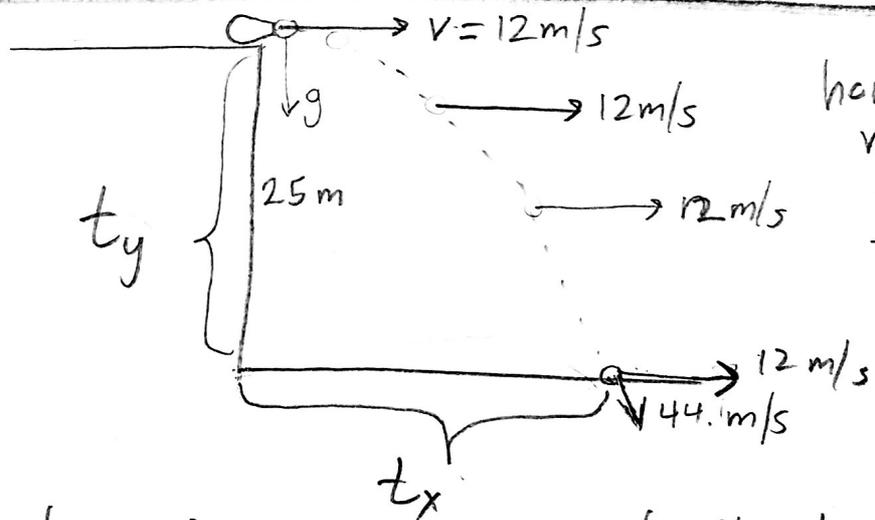
A

11. $V_i = 12 m/s$

$h = 25 m$

$t = 4.5 s$

$V_f = 44.1 m/s$



horizontal velocity stays the same.

The time it takes for the cannonball to fall in the vertical direction is the same time it takes to land in the horizontal, $t_x = t_y$

$$v = \frac{d}{t} \rightarrow 12 = \frac{d}{4.5} \rightarrow 12 \cdot 4.5 = \frac{d}{4.5} \cdot 4.5$$

$$d = 12 \cdot 4.5 = 54 m$$

C

12. $m = 10g$

$v_x = 1.2 \text{ m/s}$

$d_x = 0.51 \text{ m}$

$d_y = ?$

$$v_x = \frac{d_x}{t}$$

$$1.2 = \frac{0.51}{t}$$

$$1.2 \cdot t = \frac{0.51 \cdot t}{t}$$

$$1.2t = 0.51$$

$$t = \frac{0.51}{1.2}$$

$$t = 0.425 \text{ s}$$

now, $d_y = v_i t + \frac{1}{2} a t^2 \rightarrow d_y = 0 \cdot 0.425 + \frac{1}{2} (9.8) (0.425)^2$

$d_y = ?$

$v_i = 0 \text{ m/s}$

$t = 0.425$

$a = 9.8 \text{ m/s}^2 \leftarrow \text{gravity}$

$$d_y = \frac{1}{2} (9.8) (0.425)^2$$

$$d_y = 0.885 \text{ m} \approx 0.9 \text{ m}$$

A

13. acceleration due to gravity on Earth is -9.8 m/s^2 . The negative means downwards.

D

14. Newton's 1st Law

- also known as law of inertia, states that an object at rest remains at rest and an object moving at constant velocity stays moving at constant velocity, unless acted upon by an external force.

So, there is no acceleration.

D

15. There are no particles (air) in the vacuum of space, so the cannonball does not need another force to keep it going because there is nothing slowing it down.

D

16. $F = 100\text{N}$ $a = \text{gravity} = 9.8\text{m/s}^2$

$m = ?$

$$F = ma$$

$$100 = m(9.8)$$

$$\frac{100}{9.8} = \frac{9.8m}{9.8}$$

$$m = \frac{100}{9.8}$$

$$m = 10.2\text{ kg}$$

B

17. $F = ma \rightarrow F = m_1 a$ and $F = m_2 a$

$m_1 = 10\text{ kg}$
 $m_2 = 1\text{ kg}$

$F = 10(9.8)$
 $F = 98\text{ N}$

$F = (1)(9.8)$
 $F = 9.8\text{ N}$

↑
10 times larger

B

18. $F_f = 10\text{N}$

To maintain constant velocity all forces must be balanced, so

$F_{\text{net}} = 0\text{ N}$

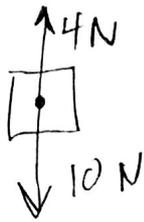
So, looking at the free-body diagram:



we need
 $F = 10\text{N}$

C

19.



$$F_{\text{net}} = 10 - 4 = 6\text{N}$$

C

20. $m = 1000\text{ kg}$
 $a = 2\text{ m/s}^2$

2 meters per second per second also means $\frac{2\text{ m/s}}{\text{s}}$ which is abbreviated to be 2 m/s^2 .

$$F = ma \Rightarrow F = (1000)(2) = 2000\text{ N}$$

D

21. $m = 30000\text{ kg}$

$F = 15000\text{ N}$
 (for each engine)

so, total force is $15000 \times 4 = 60,000\text{ N}$

$$F = ma$$

$$60,000 = 3000 a$$

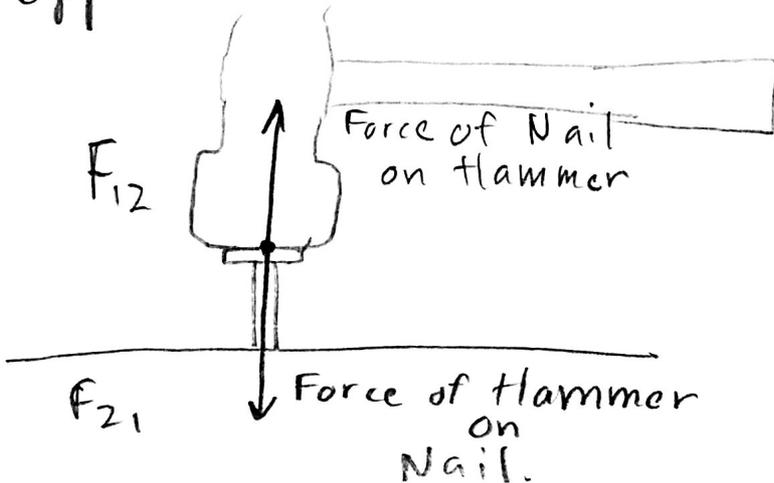
$$\frac{60,000}{30,000} = \frac{3000a}{30000}$$

$$a = 2\text{ m/s}^2$$

D

22. Newton's Third Law

For every force there is an equal and opposite force.



$$F_{12} = F_{21}$$

C

23. Equal force is exerted back to you.

A

24. $p = mv$, let's say $m = 10$ kg $p = \text{momentum}$
 $m = \text{mass}$
 $v = \text{velocity}$

$$p_1 = m_1 v_1 \quad \text{and} \quad p_2 = m_2 v_2$$

$$p_1 = 10(30)$$

$$p_2 = 10(60)$$

$$p_1 = 300$$

$$p_2 = 600$$

Doubled \rightarrow

B

25. Momentum change is the impulse defined by:

$$J = m \Delta v, \quad J = \Delta p, \quad J = F \Delta t$$

C

26. As an object collides with the padded dash board, the force is being spread out over time, which is impulse. This creates a softer landing

B

27. $p = mv$

\uparrow
If momentum changes, then velocity must change, the mass of an object cannot.

A

28. A has a higher momentum because it is much heavier and has more mass.

C

29. $v = 4 \text{ m/s}$ $p = mv$ $m = 12 \text{ kg}$

$p = 48 \text{ kg} \cdot \text{m/s}$ $48 = m \cdot 4$

$m = ?$

$$\frac{48}{4} = \frac{4m}{4}$$

B

30. If it bounces it is elastic if it bounces back to original state it is perfectly elastic, if not, inelastic.

B

31. $m = 1400 \text{ kg}$
 $v = 34 \text{ m/s}$

$$p = mv$$

$$p = 1400 \cdot 34$$

$$p = 47600 \text{ kg} \cdot \text{m/s}$$

A

32. $m = 2500 \text{ kg}$

$$F = 5 \text{ N}$$

$$a = ?$$

$$F = ma$$

$$5 = 2500 \cdot a$$

$$a = \frac{5}{2500}$$

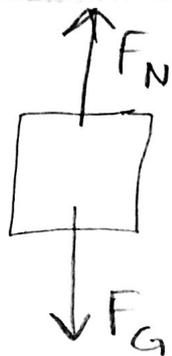
$$a = 0.002 \text{ m/s}^2$$

D

33. Since the car bounces back, it is an elastic collision.

A

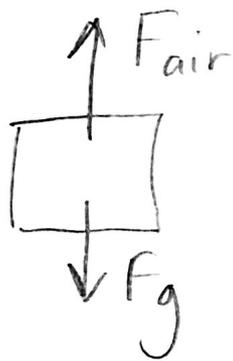
34.



This is the only case that one can say it is at rest. F_N implies it is sitting on a surface.

C

35.



This one implies that an object is in the air and possibly falling. The others happen on surfaces usually.

A

36. Work is the change in energy.

$$W = \Delta KE$$

D

37. Skateboarder K has equal amounts of KE and PE because it is halfway down the path.

B

38. When the pendulum is at its maximum height its energy can be found with

$PE = mgh$. When it's at the minimum, the energy can be found with $KE = \frac{1}{2}mv^2$.

Any where in between: $ME = PE + KE$

$$ME = mgh + \frac{1}{2}mv^2$$

$$ME = (2.8 \times 10^{-1})(9.8)(3.2 \times 10^{-2}) + \frac{1}{2}(2.8 \times 10^{-1})(9.2 \times 10^{-1})^2$$

$$ME = 0.206304$$

$$= 0.21 \text{ J}$$

39. $d = 27 \text{ m}$

$$F = 113 \text{ N}$$

$$t = 9 \text{ s}$$

$$W = F \cdot d$$

$$= 113 \cdot 27$$

$$= 3051 \text{ J}$$

$$P = \frac{W}{t} = \frac{3051 \text{ J}}{9 \text{ s}}$$

$$P = 339 \text{ Watts}$$