**Physics 11 Final Exam /114**

**Multiple Choice(/25)**

*Identify the choice that best completes the statement or answers the question.*

\_\_\_\_ 1. If a drag racer wins the final round of her race by going an average speed of 198.37 miles per hour in 4.537 seconds, what distance did he cover?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 157,401 miles | c. | 0.2500 miles |
| b. | 2.500 miles | d. | 0.0121 miles |

\_\_\_\_ 2. Construct a position-time graph that shows the forward progress of Sunny The Dog in a straight line for 20 meters over the course of 4 seconds.

|  |  |  |  |
| --- | --- | --- | --- |
| a. |  | c. |  |
| b. |  | d. |  |

\_\_\_\_ 3. Duplain St. is 300 m long and runs from west to east between Baron and Burkey. If Keith is strolling east from Baron at an average velocity of 3 km/hr, and Sue is power-walking west from Burkey at an average velocity of 6 km/hr, how long will it take them to meet?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 1 minute | c. | 3 minutes |
| b. | 2 minutes | d. | 6 minutes |

\_\_\_\_ 4. Which of the following is not true about a free body diagram?

|  |  |
| --- | --- |
| a. | All forces point away from the particle. |
| b. | The arrows are proportional to the size of the forces. |
| c. | The system is represented by a particle model. |
| d. | You always know the magnitude of the forces ahead of time. |

\_\_\_\_ 5. When an object is in equilibrium, the net force is \_\_\_\_\_.

|  |  |  |  |
| --- | --- | --- | --- |
| a. | zero | c. | negative |
| b. | positive | d. | changing |

\_\_\_\_ 6. Tension refers to

|  |  |  |  |
| --- | --- | --- | --- |
| a. | the force exerted by a string. | c. | dynamic displacement. |
| b. | terminal velocity. | d. | free fall. |

\_\_\_\_ 7. The normal force (FN) refers to

|  |  |
| --- | --- |
| a. | the parallel contact force exerted by a surface on another object. |
| b. | the perpendicular contact force exerted by a surface on another object. |
| c. | the perpendicular tension exerted by a surface on a rope. |
| d. | the parallel acceleration of a body at terminal velocity. |

\_\_\_\_ 8. A wolf spider runs 75 cm west, then turns and runs 50 cm south. Which choice gives the correct solution for the resultant?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | R2 = 752 + 502 | c. | R2 = 752  502 |
| b. | R2 = 752 + 502 - 2(75)(50) cos 60 | d. | R2 = 752  502 - 2(75)(50) cos 90 |

\_\_\_\_ 9. A 100.0 kg safe is pushed across a floor with a force of 450 N. The coefficient of kinetic friction is 0.35. What is the acceleration of the safe?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 0.98 m/s2 | c. | 5.0 m/s2 |
| b. | 1.25 m/s2 | d. | 12.5 m/s2 |

\_\_\_\_ 10. An object that is shot through the air is called a

|  |  |  |  |
| --- | --- | --- | --- |
| a. | protractor. | c. | parabola. |
| b. | projectile. | d. | proboscis. |

\_\_\_\_ 11. Karl is at a carnival. One of the midway games requires him to shoot at falling targets with an air rifle. Where should Karl aim?

|  |  |
| --- | --- |
| a. | He should aim below the falling target. |
| b. | He should aim above the falling target. |
| c. | He should aim directly at the target. |
| d. | He should aim at the ground below the target. |

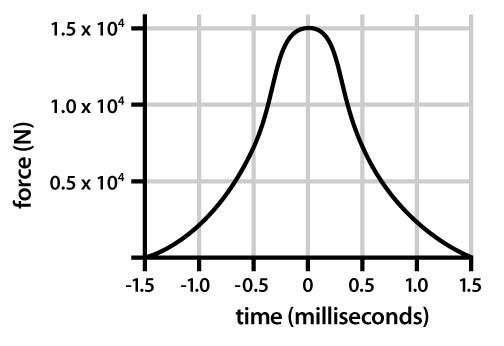
\_\_\_\_ 12. A strobe-light series of pictures is taken of a red ball and a blue ball. The red ball was allowed to drop straight down, and the blue ball was given an initial horizontal velocity. Lines are drawn connecting each red ball image with the corresponding blue ball image. Describe the lines connecting the images.

|  |  |
| --- | --- |
| a. | The lines slope down from the red ball to the corresponding blue ball. |
| b. | The lines slope up from the red ball to the corresponding blue ball. |
| c. | The lines are vertical. |
| d. | The lines are horizontal. |

\_\_\_\_ 13. Gravity is what type of force?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | field force | c. | normal force |
| b. | contact force | d. | frictional force |

\_\_\_\_ 14. Analyze the graph. Which quantity is equal to the impulse?



|  |  |  |  |
| --- | --- | --- | --- |
| a. | time of collision | c. | slope of the curve |
| b. | distance along curve | d. | area under the curve |

\_\_\_\_ 15. Which type of energy is associated with a body’s height above the ground?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | thermal energy | c. | gravitational potential energy |
| b. | elastic potential energy | d. | rest energy |

\_\_\_\_ 16. Which is an example of heating through conduction?

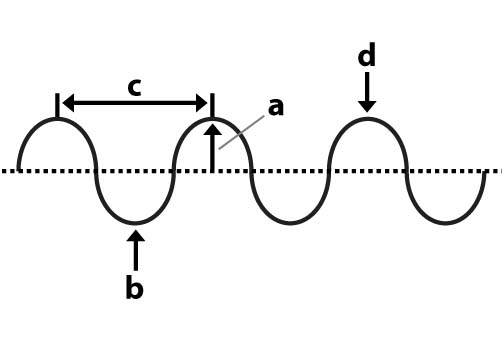
|  |  |
| --- | --- |
| a. | a ceiling fan pushes warm air downwards in winter |
| b. | touching a hot stove |
| c. | using a greenhouse to grow plants in winter |
| d. | The sun heats up the inside of a car |

\_\_\_\_ 17. Which is the transfer of thermal energy through the motion of particles caused by temperature differences?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | conduction | c. | convection |
| b. | radiation | d. | specific heat |

\_\_\_\_ 18. A 2.15 kg block of aluminum (specific heat = 897 J/kg·K) is at an initial temperature of 300 K. What will its final temperature be if 335,000 J of thermal energy are added?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 474 K | c. | 803 K |
| b. | 174 K | d. | 447 K |



\_\_\_\_ 19. In the diagram, the amplitude of the wave is shown by:

|  |  |  |  |
| --- | --- | --- | --- |
| a. | c | c. | b |
| b. | d | d. | a |

\_\_\_\_ 20. In the diagram, the crest of the wave is shown by:

|  |  |  |  |
| --- | --- | --- | --- |
| a. | c | c. | b |
| b. | d | d. | a |

\_\_\_\_ 21. What is the spring constant for a spring that stretches by 27 cm when a load of 200 N is suspended from it?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 0.135 N/m | c. | 740 N/m |
| b. | 54 N/m | d. | 7.4 N/m |

\_\_\_\_ 22. If 320 J of work is done on a spring with a spring constant of 730 N/m, how far will it stretch?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 0.58 m | c. | 0.61 m |
| b. | 0.87 m | d. | 0.94 m |

\_\_\_\_ 23. A bell with a fundamental frequency of 880 Hz is moving toward an observer at 3.5 m/s. If the speed of sound is 343 m/s, what pitch would be heard by the observer?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | 871 Hz | c. | 880 Hz |
| b. | 889 Hz | d. | 884 Hz |

\_\_\_\_ 24. Which type of image is produced by a convex mirror?

|  |  |  |  |
| --- | --- | --- | --- |
| a. | enlarged and real | c. | enlarged and virtual |
| b. | reduced and virtual | d. | reduced and real |

\_\_\_\_ 25. A concave mirror produces a smaller, inverted, real image. Which is true regarding the image distance?

|  |  |
| --- | --- |
| a. | It is between the radius of curvature and the focal point. |
| b. | It is closer to the mirror than the focal point. |
| c. | It is at the focal point. |
| d. | It is farther away than the radius of curvature. |

**Written response (/89)**

1. A car is traveling north at 88 km/hr (55 mph) on a two-lane road and enters the south end of a two-way passing zone that is 500 m long. A southbound car enters the north end of the passing zone and wishes to pass a car in front of it. How much time does the southbound driver have to pass the car and return to its lane without hitting the northbound car, if it is going 129 km/hr (80 mph)? (2)

2. Two toy dart guns are fired from the same height horizontally at the refrigerator. One dart’s suction cup sticks to the refrigerator door, but the other dart falls short. Explain why this may have happened.(2)

3. What is meant by the statement “the vertical and horizontal motions of a projectile are independent”?(1)

4. A skier travels down a slope toward the bottom of the hill. At what point(s) on the slope will gravitational potential energy and kinetic energy be equal? Ignore the effects of friction.(1)

5. On the Moon, the acceleration due to gravity is around 1.6 m/. How does this affect gravitational potential and kinetic energy of objects dropped from a height on the Moon as compared with Earth?(1)

6. James places a 100 g block of copper at 50C next to a 100 g block of silver at 20C. He asserts that at thermal equilibrium, the final temperatures of both blocks of metal will be 35C. Do you agree with James? Explain why or why not supporting with information learned by your awesome teacher Mr. Caddy.(4)

7. Explain the meaning of the negative sign in the equation for Hooke’s Law.(1)

8. Propose a scenario where the Doppler effect would cause a sound to decrease in frequency.(1)

9. Determine the critical angle for light going from diamond into water.(3)

10. A ball is thrown vertically upward with a speed of 1.53 m/s from a point 4.21 m above the ground. Calculate the time in which the ball will reach the ground.(3= 1 top, 1 down, 1 total)

11. An elevator is moving down with an acceleration of 1.40 m/s2. A 14.5-kg block hangs from a spring balance fixed to the roof of the elevator. What is the apparent weight of the block?(2)

12. Two horizontal forces, 315 N and 145 N are applied to a sled resting on a frictionless skating rink. If they are applied in the *same* direction, what is the net horizontal force on the sled?(1)

13. A 1.5 kg hawk lands on a child’s swing with a mass of 0.750 kg. What is the tension in the two vertical ropes of the swing?(2)

14. How great was this class? I mean, seriously, how much did you enjoy physics?(1)

15. A mover pushes a 30.0 kg crate across a wooden floor at a constant speed of 0.75 m/s. If the coefficient of static friction for wood-on-wood is 0.20, how much force does the mover exert on the crate?(2)

16. Two ants are using some spider webs to hoist a dead grasshopper into a tree for safe keeping. The grasshopper has a mass of 6 g. One ant stands on a branch on the left and pulls with a force of 0.15 N and the other stands at on a branch to the right and pulls with a force of 0.19 N. The web forms a perfectly vertical “V” with a 35 angle. Find the x- and y-components of the net force on the grasshopper.(6)

17. A racecar driver is driving her car down the drag strip at 140 m/s. What is the shortest distance in which she can brake and stop if the coefficient of static friction between the tires and the road is 1.11? What does this tell you about the design of cars used in drag racing?(4)

18. A paintball is shot horizontally from a paintball marker 1.75 m above the ground. The initial velocity of the paintball is 270 m/s. How long will it take for the bullet to hit the ground? Also how far will it go? (3)

19. Calculate the force of gravitational attraction between two spheres of mass 10.1 kg and 45.4 kg that are 38.5 m apart.(1)

20. A 6110-kg bus traveling at 20.0 m/s can be stopped in 24.0 s by gently applying the brakes. If the driver slams on the brakes, the bus stops in 3.90 s. What is the average force exerted on the bus in both these stops?(4)

21. An 83-kg stunt person is performing a stunt in which he jumps from the top of a 31-m-high building into a large air bag designed to break his fall safely.

a. Calculate what the momentum of the stunt person would be at ground level if the air bag were not present. (This is the quantity the air bag must be designed to handle.)(4)

b. To catch a person safely, the air bag must deflate, otherwise the person could rebound and land on a harder surface. What is the minimum time in which the air bag must deflate to stop this stunt person safely? Assume the stunt person comes to rest on the ground at the same moment the air bag deflates. For safety reasons, the force on the stunt person must not exceed his weight.(2)

c. A commercially available air bag advertises that it deflates completely in 5.0 s. What is the force on the stunt person’s body if he falls into this air bag? Is this air bag safe to use for this individual? (4)

d. What is this person’s kinetic energy and potential energy after 2.1 seconds? (4)

22. A lever’s efficiency is 95 percent. The work in is 95 J. What is the work out?(1)

23. A 68 kg skydiver decelerates from 55 m/s to 5 m/s when the skydiver’s parachute opens. What work is done on the skydiver by the parachute?(2)

24. A 91 kg man wearing a Velcro suit running with a horizontal speed of 4.4 m/s leaps into the air and impacts a stationary car of mass 880 kg sitting on a railroad track. The car is covered in Velcro, as well, and the man and the car stick together.

a) What was the initial KE of the system?(1)

b) What is the final speed of the system?(3)

c) What is the final KE of the system?(1)

d) What percentage of KE was lost?(1)

25. How fast should a car move away from an observer for the car’s horn to sound 2.48% lower in frequency than when the car is stationary? The speed of sound is 343 m/s.(3)

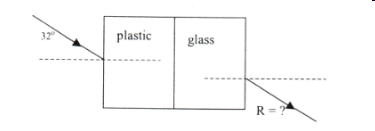
26. A museum curator needs a mirror that can produce an inverted image with a magnification of 2.5 when placed 4.0 cm from an object in a display case.

a. What kind of mirror should the curator use?(1)

b. What must be the radius of curvature?(3)

27.

Using the diagram below answer the following questions: (light n=1.0003)



a) Using snell’s law determine the 1st angle of refraction for plastic (n=1.25)(2)

b) Using snell’s law determine the 2nd angle of refraction for glass (n= 1.85)(2)

c) Determine the angle that the light ray leaves the block.(1)

28. There are many Hollywood movies which show a hero or a villain running, jumping, or riding a motorcycle through big plate glass windows without apparent injury. Why is this an incredible violation of Newton’s laws? (2)

29. In climbing stairs, you store gravitational potential energy in your body, and you get tired. Why don’t you get that gravitational potential energy back as you descend those same stairs?(2)

30. Distinguish between constructive and destructive interference.(1)

31. A group of students is discussing how light reflecting off a rough object can reflect in so many directions. Maria says that this is because the law of reflection does not apply to rough-surfaced objects but only to mirrors. Do you agree? Explain why or why not.(3)

There you’re done!!! Hurray!!!! Good job to everyone who made it to this point. I look forward to having you guys in physics 12. Put a check mark on this line \_\_\_\_\_\_\_\_ for a mark to make it out of 115.

**Physics 11 Final Exam**

**Answer Section**

**MULTIPLE CHOICE**

1. ANS: C

4.537 seconds/60sec per min = 0 .07562 min

0 .07562 min/60 min per hr = 0.001260 hr

(198.37 mph)(0.001260 hr) = 0.2500 miles

PTS: 1 DIF: Bloom's Level 3 REF: p. 44

NAT: B.4

2. ANS: B

A position-time diagram shows the distance traveled over a time interval. The slope of the line is the distance (20 m) divided by the time (4 s). Answer B shows a line with the slope of 20/4 = 5m/s, in the positive direction.

PTS: 1 DIF: Bloom's Level 4 REF: p. 38

NAT: B.4

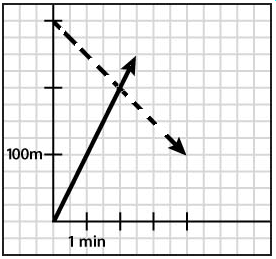
3. ANS: B

Sue is walking west at 6 km/hr = 6000m/60min = 100m/min.

Keith is walking east at 3 km/hr = 3000m/60 min = 50m/min.

By constructing a position-time graph for the two walkers, it can be seen that they will intersect after 2 minutes (Sue will have traveled 200 m, and Keith will have traveled 100 m.)

(Keith is dashed, Sue is solid.)



PTS: 1 DIF: Bloom's Level 3 REF: pp. 38-40, 43

NAT: B.4

4. ANS: D

You do not always know the magnitude of the forces ahead of time for a free-body diagram.

PTS: 1 DIF: Bloom’s Level 2 REF: p. 89

NAT: B.4

5. ANS: A

The net force on an object in equilibrium is zero.

PTS: 1 DIF: Bloom’s Level 2 REF: p. 92

NAT: B.4

6. ANS: A

The force exerted by a string or rope is called tension.

PTS: 1 DIF: Bloom’s Level 1 REF: p. 105

NAT: B.6

7. ANS: B

The perpendicular contact force exerted by a surface on another object is called the normal force.

PTS: 1 DIF: Bloom’s Level 1 REF: p. 107

NAT: B.4

8. ANS: A

R2 = 752 + 502

Use the Pythagorean theorem to solve for the resultant.

PTS: 1 DIF: Bloom’s Level 3 REF: p. 120

NAT: B.4

9. ANS: A

Find the force of friction. First, find the normal force:

(mg) = FN

(100.0 kg)(9.8 m/s2) = FN

FN = 980 N

The force of friction = kFN = k mg = 0.35(980 N) = 343 N

Since there is an acceleration, there is an imbalance between the frictional force and the horizontal push:

F Net = ma = Fp - Ff

ma = Fp - (k mg)

a = [Fp - (k mg)] / m

a = [450 N  (343 N)] / 100 kg

a = 1.07 m/s2

PTS: 1 DIF: Bloom’s Level 5 REF: pp. 126-127

NAT: B.4

10. ANS: B

The only force on a projectile is the force of gravity.

PTS: 1 DIF: Bloom’s Level 1 REF: p. 147

NAT: B.4

11. ANS: C

The projectile from the gun will fall at the same rate as the target. This is one of the easiest shots to make.

PTS: 1 DIF: Bloom’s Level 3 REF: pp. 148-150

NAT: B.4

12. ANS: D

Horizontal motion is independent of vertical motion.

PTS: 1 DIF: Bloom’s Level 5 REF: pp. 148-149

NAT: B.4

13. ANS: A

Gravity is a field force.

PTS: 1 DIF: Bloom’s Level 2 REF: p. 182

NAT: B.4

14. ANS: D

When force is not constant, impulse is given by the area under the force v. time curve.

PTS: 1 DIF: Bloom's Level 4 REF: p. 230

NAT: B.4

15. ANS: C

Gravitational potential energy is defined in relation to a reference level where gravitational PE is zero.

PTS: 1 DIF: Bloom's Level 1 REF: pp. 288-289

NAT: B.5 | B.6

16. ANS: B

When you touch a hot stove, you rapidly heat your hand through conduction.

PTS: 1 DIF: Bloom's Level 3 REF: p. 317

NAT: B.6

17. ANS: C

Thermal energy transferred by the motion of particles is called convection.

PTS: 1 DIF: Bloom's Level 2 REF: p. 317

NAT: B.6

18. ANS: A

335,000 J = 2.15 kg · 897 J/kg·K · ()



PTS: 1 DIF: Bloom's Level 3 REF: p. 318

NAT: B.6

19. ANS: A

The amplitude of a wave is half the height of the wave from crest to trough.

PTS: 1 DIF: Bloom's Level 2 REF: pp. 382-383

NAT: B.6

20. ANS: D

The crest of a wave is the top of the wave.

PTS: 1 DIF: Bloom's Level 2 REF: p. 383

NAT: B.6

21. ANS: C

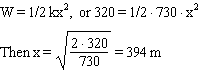
For the elastic force on a spring, F = 

Here, 200 N/ 0.27 m = 740 N/m.

PTS: 1 DIF: Bloom's Level 3 REF: p. 376

NAT: UCP.3

22. ANS: D



PTS: 1 DIF: Bloom's Level 3 REF: p. 376

NAT: UCP.3

23. ANS: B

The sound becomes higher in pitch as its source moves toward an observer.

PTS: 1 DIF: Bloom's Level 3 REF: pp. 407-408

NAT: UCP.3

24. ANS: B

A convex mirror always produces a reduced and virtual image.

PTS: 1 DIF: Bloom's Level 3 REF: p. 473

NAT: B.6

25. ANS: A

When an object is placed between the radius of curvature and the focal point of a concave mirror, the resulting image is reduced and inverted.

PTS: 1 DIF: Bloom's Level 3 REF: p. 473

NAT: B.6

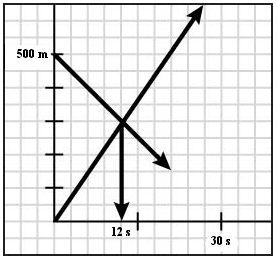
**Physics Final Part B**

**Answer Section**

**SHORT ANSWER**

1. ANS:

Draw the position-time graph for the two cars. The point where the lines cross gives the time to collision, which is about 12 seconds.

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PTS: 1 DIF: Bloom's Level 3 REF: pp. 38-40, 43

NAT: B.4

2. ANS:

The dart that fell short of the fridge had a slower launch speed than the one that stuck. So it hit the ground before reaching the fridge.

PTS: 1 DIF: Bloom's Level 4 REF: pp. 148-150

NAT: B.4

3. ANS:

The horizontal motion of a projectile does not affect the vertical motion of a projectile. The vertical motion of a projectile does not affect the horizontal motion of a projectile.

PTS: 1 DIF: Bloom's Level 4 REF: pp. 148-149

NAT: B.4

4. ANS:

At any point along the path where the vertical distance is halfway between the top and the bottom, gravitational potential energy and kinetic energy will be equal.

PTS: 1 DIF: Bloom's Level 2 REF: p. 294

NAT: B.5 | B.6

5. ANS:

Both gravitational potential energy and the resulting kinetic energy are smaller for objects dropped on the Moon as compared to objects dropped on Earth.

PTS: 1 DIF: Bloom's Level 6 REF: p. 289

NAT: B.5 | B.6

6. ANS:

James is incorrect. The final temperature depends on the specific heat of the each substance. Since the silver has a lower specific heat, it will change in temperature more than the copper as thermal energy is exchanged.

PTS: 1 DIF: Bloom's Level 6 REF: pp. 315, 317-318

NAT: B.6

7. ANS:

In Hooke’s Law, F = kx. The sign is negative because the force of the spring is always opposite to the displacement of the spring.

PTS: 1 DIF: Bloom's Level 6 REF: p. 376

NAT: UCP.3

8. ANS:

Answers will vary. This situation will occur with these conditions:

stationary source, observer moves away

stationary observer, source moves away

observer and source are moving in opposite directions

PTS: 1 DIF: Bloom's Level 5 REF: pp. 407-408

NAT: B.6

9. ANS:

write out

PTS: 1

**PROBLEM**

10. ANS:

1.10 s

PTS: 1 DIF: Bloom’s Level 3 REF: Page 72

OBJ: 3.3.2 Solve objects involving objects in free fall. NAT: B.4

TOP: Solve objects involving objects in free fall. KEY: Free fall

MSC: 3

NOT: The total time is the sum of the time taken by the ball to reach its topmost point and the time to come down from the topmost point to the ground.

11. ANS:

12.4 N

PTS: 1 DIF: Bloom’s Level 2 REF: Page 96

OBJ: 4.2.2 Differentiate between actual weight and apparent weight.

NAT: B.4 TOP: Differentiate between actual weight and apparent weight.

KEY: Apparent weight MSC: 3

NOT: Use Newton's second law to find the apparent weight of the block.

12. ANS:

315 N + 145 N = 460 N

PTS: 1 DIF: Bloom’s Level 3 REF: p. 92

NAT: B.4

13. ANS:

The total tension is the sum total of the forces on the ropes.

Total force = (1.5 kg + 0.750 kg)  9.8 m/s2 = 22.05 N

There are 2 ropes, so each bears half the tension: 22.05 / 2 = 11.0 N each

PTS: 1 DIF: Bloom’s Level 4 REF: p. 105

NAT: B.4

14. ANS:

98.7°

PTS: 1 DIF: Bloom’s Level 3 REF: Page 122

OBJ: 5.1.3 Solve for the sum of two or more vectors by adding the components of the vectors.

NAT: B.4

TOP: Solve for the sum of two or more vectors by adding the components of the vectors.

KEY: Sum of vectors MSC: 3

NOT: Resolve one of the vectors into components along and perpendicular to the second vector.

15. ANS:

Fp = k mg

= (0.20)(30.0 kg)(9.8 m/s2)

= 58.8 N

PTS: 1 DIF: Bloom’s Level 3 REF: pp. 126-131

NAT: B.4

16. ANS:

The force of gravity on the grasshopper is in the y-direction:

Fg = mg

Fg = (0.006 kg)(9.8 m/s2)

Fg = 0.0588 N

The stronger ant exerts a force in the y-direction and in the x-direction.

Fy = cos  (0.19 N)

Fy = cos 17.5 (0.19 N)

Fy = 0.181 N

Fx = sin  (0.19 N)

Fx = sin 17.5 (0.19 N)

Fx = 0.0571 N

The weaker ant exerts a force in the y-direction and in the x-direction.

Fy = cos  (0.15 N)

Fy = cos 17.5 (0.15 N)

Fy = 0.143 N

Fx = sin  (0.15 N)

Fx = sin 17.5 (0.15 N)

Fx = 0.045 N

Overall, the grasshopper has a force of 0.265 N upward in the y-direction, and 0.0121 N to the right in the x-direction.

PTS: 1 DIF: Bloom’s Level 5 REF: pp. 122-123, 131

NAT: B.4

17. ANS:

vf2 = vi2 + 2a(df  di)

Let vf  = 0 and df  di = d

0 = vi2 + 2a(d)

d = - vi2 / 2a

The weight in the y-direction = the normal force.

F = F = smg = ma

a = sg

d = - vi2 / (2(sg)

d = vi2 / (2(sg)

d = (140 m/s)2 / [2(9.8 m/s2)()]d =

The cars had better have other mechanisms for stopping, besides the brakes.

PTS: 1 DIF: Bloom’s Level 6 REF: pp. 79, 126-127

NAT: B.4

18. ANS:

The only force acting on the paintball to cause it to hit the ground is gravity. The time that it will take for a fired paintball to hit the ground is the same as if it were dropped vertically from the same height. There is no initial velocity downwards.

df = di + vitf + 1/2atf2

1.75 m = 0 m + 0(t) + 1/2(9.8 m/s2)(t)2

t = 0.60 s

PTS: 1 DIF: Bloom's Level 4 REF: pp. 148-149

NAT: B.4

19. ANS:

 N

PTS: 1 DIF: Bloom’s Level 3 REF: Page 177 | Page 178

OBJ: 7.1.3 Describe the importance of Cavendish's experiment.

NAT: B.4 TOP: Describe the importance of Cavendish's experiment.

KEY: Gravitational force MSC: 3

NOT: Use the mathematical form of Newton's law of gravitation.

20. ANS:

**  N

**  N

PTS: 1 DIF: Bloom's Level 3 REF: Page 230

OBJ: 9.1.2 Determine the impulse given to an object. NAT: B.4

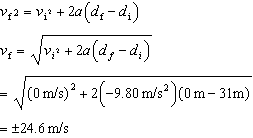
TOP: Determine the impulse given to an object. KEY: Impulse

MSC: 3

NOT: Apply the impulse-momentum theorem to obtain the force needed to stop the vehicle.

21. ANS:

a. To find the final velocity of the falling stunt person,



Since the stunt person is falling in the downward direction, we take the negative value as our velocity, *v*f = –24.6 m/s.

*p*f = *mv*f

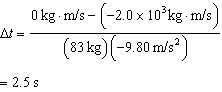
= (83 kg)(–24.6 m/s)

= –2.0103 kg·m/s

b. *F**t* = pf  p1

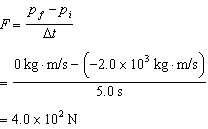


With the stunt person finishing at rest, *v*f = 0 m/s and *p*f = 0 kgm/s:



c. The force on the stunt person’s body is the force exerted by the air bag:

*F**t* = *p*f  *p*i



When he falls, the stunt person exerts a force equal to his own body weight:F = *mg* = (83 kg)(9.80 m/s2) = 813 N

Yes, this air bag is safe for the stunt person to use. The force experienced by the stunt person is less than his own body weight.

d. *F**t* = *p*f  *p*i = *mv*f  *mv*i

*mg**t* = *mv*f  *mv*i = *mv*f

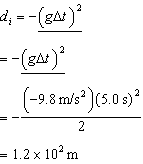
*v*i = 0 m/s

*v*f = *g**t*

Substitute this value for *v*f —along with the values *v*i = 0 m/s, *d*f = 0 m, and a = g— into our original velocity equation.

*v*f2 = *v*i2 + 2a(*d*f  *d*i)

(g*t*)2 = 2g(di)



PTS: 1

22. ANS:

90 J

PTS: 1 DIF: Bloom's Level 3 REF: p. 268

NAT: B.5 | B.6

23. ANS:

1.0  105 J

PTS: 1 REF: pp. 286-287 NAT: B.5 | B.6

24. ANS:

a) initial KE = 880 J

b) final speed = 0.41 m/s

c) final KE = 83 J

d) 91 %

PTS: 1 DIF: Bloom's Level 3 REF: pp. 287, 298

NAT: B.5 | B.6

25. ANS:

8.72 m/s

PTS: 1 DIF: Bloom's Level 3 REF: Page 403 | Page 407

OBJ: 15.1.3 Identify some applications of the Doppler effect.

TOP: Identify some applications of the Doppler effect. KEY: Doppler effect

MSC: 3

NOT: When a sound source moves away from a stationary observer, the wavelength of sound increases. The apparent frequency is lower than the true frequency.

26. ANS:

a. The mirror must be concave, because only a concave mirror can produce magnified images.

b. First find the image distance using the magnification:

Because the image is inverted, the real magnification value is 2.5.

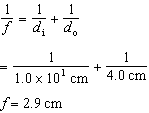


*d*i = *md*o

= (2.5)(4.0 cm)

= +1.0101 cm

Then calculate the focal length:



The radius of curvature is therefore given by:

*r* = 2*f* = 2(2.9 cm) = 5.8 cm

Image is enlarged and inverted only if *r*  do  , which is true for this value of *r*.

PTS: 1

27. ANS:

Work out

PTS: 1

**ESSAY**

28. ANS:

Broken glass can injure a person through two mechanisms: Weight and inertia. Large, heavy shards of broken glass can fall like guillotines. In order to stop this heavy, accelerating mass, a force would need to be applied in the opposite direction. If the force is applied by the limb of a person, it is much more likely that the person will lose the limb than the glass will be stopped.

When a character jumps or drives a motorcycle through a window, the shards of glass will tend to stay in place due to inertia. The only way to move them out of the way is to apply a force. If the person's body provides this force by pushing on the edge of a piece of glass, it can slice right through clothing, skin, and flesh. In the real world, jumping or driving through a plate glass window would be deadly.

PTS: 1 DIF: Bloom’s Level 6 REF: p. 93

NAT: B.4

29. ANS:

You actually do get a little of that energy back with each step, but instead of converting it all to kinetic energy, you convert that gravitational potential energy into other forms in the inelastic collisions of your foot with each step. Some of those forms of energy are heat (friction with the steps), vibration (the push of the stair on your foot), and sound (the clip-clop of your shoes on the steps).

PTS: 1 DIF: Bloom's Level 4 REF: pp. 289, 293

NAT: B.5 | B.6

30. ANS:

Both types of interference result from the superposition of two (or more) waves. In constructive interference, the displacement of both waves is in the same direction, resulting in a total amplitude that is the sum of the two displacements. In destructive interference, the magnitudes of the waves’ amplitudes are equal but in opposite directions, and the resulting sum of amplitudes is zero.

PTS: 1 DIF: Bloom's Level 5 REF: p. 389

NAT: B.5

31. ANS:

Maria is not correct. The law of reflection applies to all surfaces that are struck by light. The reason that rough-surfaced objects produce diffuse reflections is that there are many different points at which light rays hit the surface. Each ray strikes the surface at a different angle of incidence, so the angles of reflection are also all different. This produces scattering of light rather than one smooth reflected beam of light.

PTS: 1 DIF: Bloom's Level 6 REF: pp. 458-459

NAT: B.6