

Physics EOC Review

1-D Kinematics

- 1) A toy car with an initial velocity of 5.0 m/s experiences a constant acceleration of 2.0 m/s^2 . What is the final velocity after 6.0 s?
 - 2) A car is coasting backwards downhill at a speed of 3.0 m/s when the driver gets the engine started. After 2.5 s, the car is moving uphill at 4.5 m/s. If uphill is chosen as the positive direction, what is the car's average acceleration?
 - 3) An arrow was shot vertically upward at a velocity of 50.0 m/s. What was its velocity after 2.00 seconds?
 - 4) A truck starts from rest at a traffic light. It takes 60.0 s to reach a speed of 29.0 m/s. What is the truck's acceleration during this time interval?
 - 5) A student throws a book vertically downward toward the river below with an initial velocity of 5.2 m/s. If the book hits the water after 1.5 s, what is the height of the bridge?
 - 6) An aircraft changes velocity from 150 m/s to 250 m/s with an average acceleration of 8.3 m/s^2 . How far does the aircraft travel in a straight line during its period of acceleration?
 - 7) Jim runs at a velocity of 5.4 m/s for 23.0 min. When going up an increasingly steep hill, he slows down at a constant rate of 0.06 m/s^2 for 92.0 s & comes to a stop. How far did he run?
 - 8) An airplane accelerates from rest at a constant 2.50 m/s^2 for 26.1 s before leaving the ground.
 - (a) How far did the airplane move?
 - (b) How fast was the airplane going when it took off?
 - 9) A baseball is thrown straight up in the air with an initial speed of 25.2 m/s. It is caught at the same distance above the ground.
 - (a) How high does the ball rise?
 - (b) How long does the ball remain in the air?
 - 10) A car is traveling 10.0 m/s when the driver sees a child standing in the road. She takes 0.50 s to react, then she brakes and slows at 7.0 m/s^2 . How far does the car go before it stops?
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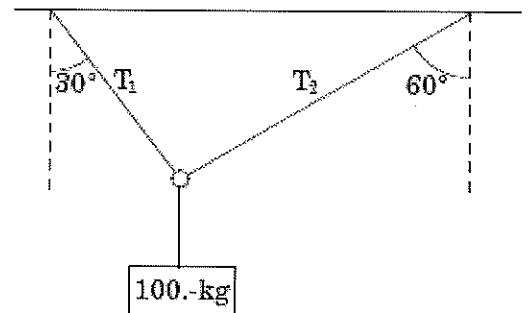
2-D Kinematics

- 11) A person throws a rock horizontally out of a window of a building with a speed of 10.0 m/s. The window is 30.0 m above the ground. How far from the building will the rock strike the ground?
- 12) An object moving in a horizontal circle with a radius of 2.80 m completes each lap in 3.00 s. What is the acceleration of the object?
- 13) A woman walked 5.0 km east, 4.0 km north, and 2.0 km west in 3.0 hours. What was her average velocity?
- 14) A pilot wants to fly a plane east at a velocity of 400.0 km/hr with respect to the ground. A 50.0 km/hr wind is blowing southward. With respect to the air, what velocity must the pilot maintain?
- 15) Cheetahs are, for short distances, the fastest land animals. In the course of a chase, they can also change directions very quickly. Suppose a cheetah runs straight north for 5.0s, quickly turns and runs $3.00 \times 10^2 \text{ m}$ west. If the magnitude of the cheetah's resultant displacement is $3.35 \times 10^2 \text{ m}$, what is the cheetah's displacement and velocity during the first part of its run?

- 16) Lookout Mountain, overlooking the Tennessee River Valley near Chattanooga, TN, was of great strategic importance during the Civil War. Today, some of the artillery used in the war remain at the park located on top of the mountain. Suppose one of these cannons fired a projectile horizontally with a speed of 430 m/s, so that the projectile landed at a horizontal distance of 4020 m from the cannon. How high would the ridge of the mountain be with respect to the valley below?
- 17) A flying fish leaps out of the water with a speed of 15.3 m/s. Normally these fish use wing-like fins to glide about 40 m before reentering the ocean, but in this case the fish fails to use its "wings" and so only travels horizontally about 17.5 m. At what angle with respect to the water's surface does the fish leave the water?
- 18) A downed pilot fires a flare from a flare gun. The flare has an initial speed of 250 m/s and is fired at an angle of 35° to the ground. How long does it take for the flare to reach its maximum altitude?
- 19) A bird flies directly into a wind. If the bird's forward speed relative to the wind is 58.0 km/h and the wind's speed in the opposite direction is 55.0 km/h, relative to Earth, how long will it take the bird to fly 1.4 km?
- 20) A polar bear swims 2.60 m/s south relative to the water. The bear is swimming against a current that moves 0.78 m/s at an angle of 40.0° north of west, relative to Earth. How long will it take the polar bear to reach the shore, which is 5.50 km to the south?

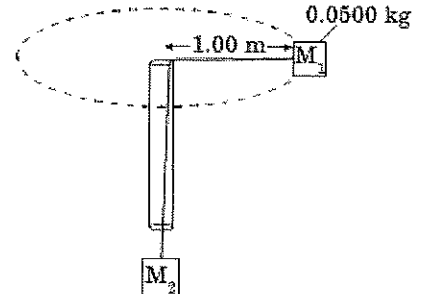
Forces

- 21) A sailboat with a mass of 2.0×10^3 kg experiences a tidal force of 3.0×10^3 N directed to the east and a wind force against its sails with a magnitude of 6.0×10^3 N directed toward the northwest (45° N of W). What is the magnitude of the resultant acceleration of the boat?
- 22) An elevator weighing 2.00×10^5 N is supported by a steel cable. What is the tension in the cable when the elevator is accelerated upward at a rate of 3.00 m/s²?
- 23) An elevator is moving down with an acceleration of 3.36 m/s². What would be the apparent weight of a 64.2-kg man in the elevator?
- 24) John is pushing a 50.0-kg cart at a constant velocity along a horizontal floor with a horizontal force of 200. N. What is the magnitude of the frictional force that the cart is experiencing?
- 25) A wagon with a weight of 300.0 N is accelerated across a level surface at 0.5 m/s². What net force acts on the wagon?
- 26) A 100.-kg object is hung from the ceiling by two ropes, T_1 and T_2 . If the tension in rope T_2 is 490. N, what is the tension in T_1 ?
- 27) A sled is pulled at a constant velocity across a horizontal snow surface. If a force of 8.0×10^1 N is being applied to the sled rope at an angle of 53° to the ground, what is the force of friction between the sled and the snow?
- 28) A mule uses a rope to pull a box that weighs 3.0×10^2 N across a level surface with constant velocity. The rope makes an angle of 30.0° above the horizontal, and the tension in the rope is 1.0×10^2 N. What is the normal force of the floor on the box?
- 29) If a woman weighs 750.N on Earth, what would she weigh on a planet that has $\frac{1}{2}$ the mass and $\frac{1}{2}$ the radius of Earth?



- 30) A 3.08×10^4 kg meteorite is on exhibit in New York City. Suppose this meteorite and another meteorite are separated by 1.27×10^7 m (a distance equal to Earth's average diameter). If the gravitational force between them is 2.88×10^{-16} N, what is the mass of the second meteorite?
- 31) A 0.50-kg stone at the end of a string with a length of 0.60 m is rotating in a vertical circle at the uniform speed of 2.0 m/s. At the bottom of this path, what is the tension in the string?

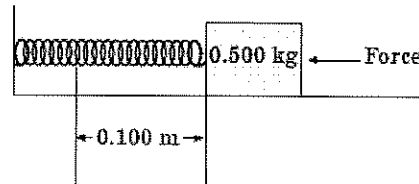
- 32) Several students in a physics lab set up an apparatus shown in the diagram below. M_1 is a 0.0500-kg mass attached to a cord threaded through a glass tube holder and spun in a circular path nearly parallel to the floor. What is the mass of M_2 required to maintain a speed of 12.6 m/s and a radius of 1.00 m? Neglect friction.



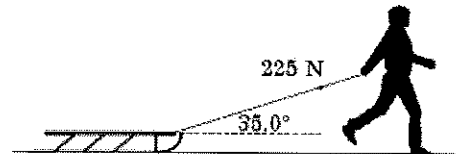
Energy

- 33) A father (100 kg) and his son (50 kg) go on a hike in the mountains. The father takes 60 minutes to climb the mountain, and the son climbs it in 30 minutes. How do their potential energies compare?

- 34) A spring ($k = 5.00 \times 10^3$ N/m) is compressed 0.100 m when a 0.500-kg block resting on a frictionless surface is pushed against the spring as shown in the accompanying diagram. What is the kinetic energy of the block when it is released?



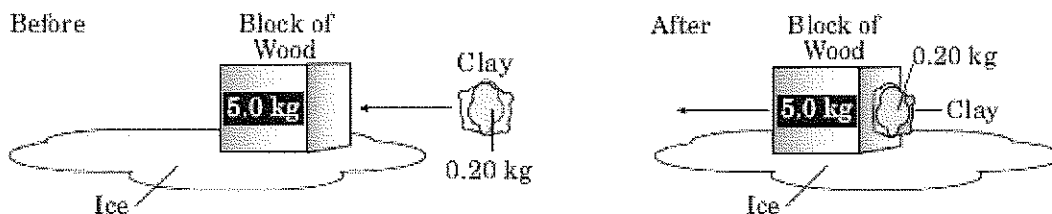
- 35) A 0.500-kg arrow was shot vertically upward with an initial velocity of 55.0 m/s. What was the arrow's kinetic energy after two seconds of flight?
- 36) A 650.-kg car traveling at 5.00 m/s was stopped by applying the brakes. How much work did the brakes do when stopping the car?
- 37) A student pulls a sled across level snow with a force of 225 N with a rope that is 35.0° above the horizontal. If the sled moved a distance of 65.3 m, how much work did the student accomplish?



- 38) A worker carries a 100-N crate horizontally at a constant speed across a 10-m room. How much work is done against gravity by the worker?
- 39) What is the average power supplied by a 60.0 kg person running up a flight of stairs rising vertically 4.0 m in 4.2 s?
- 40) A worker pushes a wheelbarrow with a horizontal force of 50.0 N over a level distance of 5.0 m. If a frictional force of 43 N acts on the wheelbarrow in a direction opposite to that of the worker, what net work is done on the wheelbarrow?
- 41) A hill is 100 m long and makes an angle of 12° with the horizontal. As a 50 kg jogger runs up the hill, how much work does gravity do on the jogger?
- 42) A 15.0 kg crate, initially at rest, slides down a ramp 2.0 m long and inclined at an angle of 20.0° with the horizontal. Using the work-kinetic energy theorem and disregarding friction, find the crate's velocity at the bottom of the ramp.
- 43) A parachutist with a mass of 50.0 kg jumps out of an airplane at an altitude of 1.00×10^3 m. After the parachute deploys, the parachutist lands with a velocity of 5.00 m/s. Using the work-kinetic energy theorem, find the energy that was lost to air resistance during this jump.

Momentum

- 44) A 6.0×10^{-2} kg tennis ball moves at a velocity of 12 m/s. The ball is struck by a racket, causing it to rebound in the opposite direction at a speed of 18 m/s. What is the change in the ball's momentum?
- 45) A swimmer with a mass of 75 kg dives off a raft with a mass of 500 kg. If the swimmer's speed is 4 m/s immediately after leaving the raft, what is the speed of the raft?
- 46) A bullet with a mass of 5.00×10^{-3} kg is loaded into a gun. The loaded gun has a mass of 0.52 kg. The bullet is fired, causing the empty gun to recoil at a speed of 2.1 m/s. What is the speed of the bullet?
- 47) A diver with a mass of 80.0 kg jumps from a dock into a 130.0 kg boat at rest on the west side of the dock. If the velocity of the diver in the air is 4.10 m/s to the west, what is the final velocity of the diver after landing in the boat?
- 48) Identify the following types of collisions:
- Two objects move separately after colliding, & both total momentum and total KE remain constant.
 - After colliding, objects are deformed and lose some kinetic energy.
 - Two billiard balls collide.
 - Two balls of dough collide and stick together.
- 49) A bowling ball with a mass of 7.0 kg strikes a pin that has a mass of 2.0 kg. The pin flies forward with a velocity of 6.0 m/s, and the ball continues forward at 4.0 m/s. What was the original velocity of the ball?
- 50) While rolling on a rough surface, the momentum of a ball becomes half its original value. How does the ball's final velocity compare with its original velocity?
- 51) A ball of mass 0.5 kg is acted upon by a force of 20 N for 2 s. What is the impulse imparted?
- 52) A 0.75-kg soccer ball is rolling toward a player at 6.1 m/s. The player kicks the ball and it rolls in the opposite direction at 15 m/s. If the ball is in contact with the player's foot for 0.05 s, what average force did the player exert on the ball?
- 53) A 5.0-kg block of wood rests on a frozen pond. A 0.20-kg lump of clay strikes the block and sticks to it. The block and clay then move together at 1.5 m/s. What was the velocity of the incoming clay?

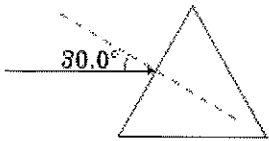


Waves

- 54) Light travels through air and enters fused quartz. The refracted angle is 36.2° . What is the angle of incidence?
- 55) Waves propagate along a stretched string at a speed of 8.0 m/s. The end of the string vibrates up & down once every 1.5 s. What is the wavelength of the waves traveling along the string?

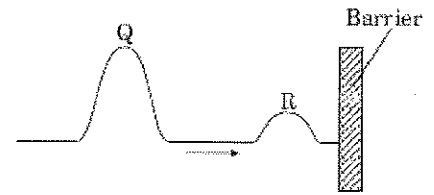
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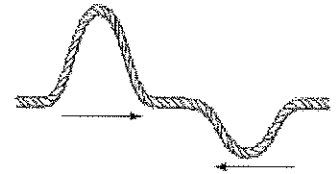
56) A beam of red light enters a crown glass prism on the path shown to the left. What is the angle of refraction?

57) In the drawing shown here, pulses Q and R are traveling down a rope attached to a rigid barrier. When the reflection of R interferes with Q, what will the rope look like? Draw the resulting wave.

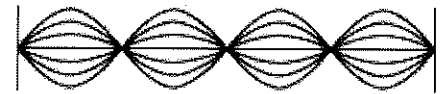


58) When light passes at an angle into another material in which its speed is lower, what happens to the beam of light?

59) Which type of interference will occur in the rope shown to the right?



60) How many nodes and antinodes are shown in the standing wave shown below?



61) A beam of light in air is incident at an angle of 35° to the surface of a rectangular block of clear plastic ($n = 1.49$). What is the angle of refraction?

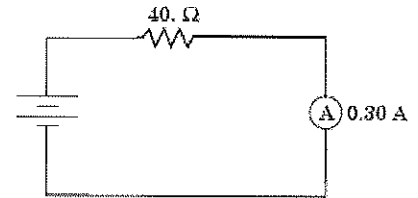
62) If the light in air approaches a clear oil's surface at an angle of 47.9° to the normal and moves into the oil at an angle of 29.0° to the normal, what is the oil's index of refraction?

63) What will be the speed of light traveling through glycerol?

Electricity

64) Two charges separated by a distance d exert a force F on each other. What is the force between the same charges if the distance is increased to $2d$?

65) Consider the diagram to the right. What is the potential difference across the $40\text{-}\Omega$ resistor in the circuit?



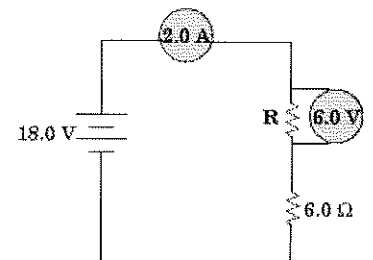
66) Ten volts are applied across a $100\text{-}\Omega$ resistor. How many watts are dissipated by the resistor?

67) A light bulb is connected across a 6.0-V potential difference. The current in the circuit is measured at 0.75 A . What is the power rating of the light bulb?

68) What is the process of charging a conductor by bringing it near another charged object and then grounding the conductor is called?

69) Consider the diagram to the right. What resistance, R , will result in the current and voltage measurements shown?

70) If a $5.00 \times 10^2\text{ W}$ heater has a current of 4.00 A , what is the potential difference across the heating element?



71) Two resistors with values of $6.0\ \Omega$ and $12\ \Omega$ are connected in parallel. This combination is connected in series with a $4.0\ \Omega$ resistor. What is the equivalent resistance of this combination?

72) What is the electrical force between an electron and a proton that are separated by a distance of $1.0 \times 10^{-10}\text{ m}$?

73) Determine the current in and the potential difference across the $10.0\ \Omega$ resistor in the circuit diagram at right.

