Force, Motion & Simple Machines

Study Guide Answers

* Definitions:
* Distance is the total length of motion/movement from start to finish.
* Displacement is the difference between start and finish with direction.
* Speed is determine by the distance traveled in a specific amount of time. S= D/T Ex: 55 kmh
* Velocity is speed with direction. Ex: 55 kmh East
* Acceleration is any change in velocity including speed, distance, and/or direction.
* A speed limit sign shows the distance and time allowed for travel. Ex: 35 kmh….km (distance) h (time)
* Formulas:
* Speed or velocity S=D/T (Distance divided by Time) …add direction for velocity
* Acceleration Vf - VI /T (Final velocity minus Initial velocity divided by time)
* Variables:
* 12 m (“m” is the symbol for meters which is the variable distance)
* +2 m/s2 ( “+” or “-“ are symbols indicating an increase or decrease in speed. This indicates acceleration. Also known as positive acceleration—speeding up OR negative acceleration---slowing down.)
* 100 kmh (“km”—distance; “ h”—time; these variables indicate speed)
* 12.5 cm (“cm” represent distance…since no other variable is given, this is simply distance.)
* 14 m, west (“m” represents distance; west gives direction—variables representing distance with direction indicates displacement)
* 2.5 m/s, up (“m/s” represents distance and time which is speed; “up” gives direction---speed with direction is velocity)
* Runner diagrams:
* R1’s Distance is 7 km
* R1’s Displacement is 1km, north
* R2’s Speed is 4kmh
* R2’s Velocity is 4kmh, east
* R3’s Speed is 10 kmh
* R3’s Velocity is 10 kmh, west
* R4’s Distance is 400m
* R4’s Displacement is zero. The runner started and stopped at the same point.
* R4’s speed is 1.11 m/s. (4 laps at 100 m per lap = 400; (6 minutes- 6 X 60= 360 secs; 400/360= 1.11 m/s)
* R4’s Velocity is constantly changing due to running around the track---the direction changes at every turn—1.11 m/s, east; 1.11 m/s, west; 1.11 m/s, north, 1.11 m/s south. This represents constant acceleration; even though the speed is not changing---the direction is.
* Ball drawing:
* The velocity is changing---even though the motion is constant, the direction is changing.
* The scenario states the ball is in “constant motion” indicating the speed is not changing.
* The acceleration is changing due to the change in direction as the ball is moving.
* Word problems:
* The problem is asking for speed (S=D/T) 200m/4h= 50mph Answer: 50 mph
* Acceleration = Vf - VI /T ( 25m/s – 0 m/s / 5s = 25m/s / 5s = 5 m/s2 ) Answer: 5 m/s2
* Dot path motions:
* Path 1 illustrates positive acceleration---the distance between dots gets farther apart indicating that the traveler is speeding up –covering more distance in the same amount of time.
* Path 2 illustrates no acceleration—the distance between dots remains constant indicating no change in speed or direction.
* Path 3 illustrates negative acceleration and positive acceleration---the distance between dots in the middle decreases indicating the traveler is slowing down (negative acceleration)—not covering as much distance in the same amount of time, then speeding up (positive acceleration) towards the end (distance between dots increases).
* Motion Graphs:
* Distance/Time (speed) graph with no change in distance over time; the object is not moving.
* Velocity /Time (acceleration) graph illustrating velocity increasing over time. This represents acceleration.
* Velocity /Time (acceleration) graph illustrating no change in velocity over time representing constant speed. No change in speed or direction---NO acceleration.
* Distance/Time (speed) graph illustrating constant change in distance over time representing constant motion.
* Acceleration/Time graph illustrating no change in acceleration over time. Whatever the motion is, it is not changing.
* Graph drawings:
* The first point should be marked at the top of the distance axis, then draw diagonally to the right to about mid-way down. At this point the line should be drawn horizontally indicating no change in motion—about an inch; then continue drawing the line diagonally to the right until it reaches the right side of the time axis---indicating the traveler has reached home.
* The first point should be drawn horizontally from the velocity axis—maybe an inch; then draw diagonally upwards to the right of the time axis.
* Define:
* Force is a push or a pull.
* Balanced force occurs when all forces are equal.
* Unbalanced force occurs when forces are not equal. This results in a net force.
* Gravity is a downward force.
* Inertia is the tendency to resist a change in motion.
* Friction is an opposing force.
* Diagrams with net force:
* 50 n to the right (the object will move to the right)
* 50 n to the left (the object will move to the left)
* 100 n down (the object will move down)
* Diagrams with zero net force:
* 0 net force (the motion of the object will not change)
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* 0 net force (the motion of the object will not change)
* The objects in #13 have balanced forces. There is no net force, so the motion of the object will not change.
* The formula for Force is mass X acceleration. Force is measured in units called Newtons.
* Two types of forces are:
* Force of gravity (Fg). Gravity is a downward force.
* Force of friction (Ff). Friction is an opposing force.
* The force of friction opposes motion.
* Weight is the effect of gravity on a mass. Mass remains the same whether you are on Earth, the Moon, or Pluto---mass does not change, but gravitational force DOES change, depending on location.
* Gravity is a force.
* The SI (metric) unit for weight is newtons
* The SI (metric) unit for gravity is meters per second squared (m/s2).
* Remember….mass does not change!!! At every point in the diagrams the mass is 20 kg.
* Remember, weight is the effect of gravity on a mass…so, in the diagrams the weight will be greatest at the point where the mass is closest to the source of the gravitational force. In the first diagram, the weight would be greatest at the lowest point. In the second diagram the weight would be greatest on Neptune because it has the greatest gravitational force.
* A satellite remains in orbit because it accelerates just enough to overcome the gravitational force of the object it is orbiting. If the satellite slows down it will be pulled back down to the object. If it speeds up, the object will escape the gravitational force of the object and move out into space.
* Work is done when an object moves in the direction of the force that is applied. If the object does not move in this direction, then no work is done.
* W1  < Wo  (Cannot get more work out of something than is put into it.)
* W1  = Wo  (Cannot be equal—can’t get out what you put in.)
* W1  > Wo  (Correct---input work is always greater than output work.)
* Two types of machines are simple machines and complex machines.
* See graphic organizer and/or text book pictures and diagrams for each type of machine.
* 3 ways machines make work easier are:
* Increasing force
* Increasing distance
* Changing the direction of the force that is applied.
* Work can be made easier—NOT LESS—because we cannot get more work out of a machine than is put into it.
* Machines made up of 2 or more simple machines are called complex machines.

1. Complex machines pictures:

* A wheel barrow is made up of a lever and a wheel and axle.
* A can opener is made up of a wheel and axle, lever, wedge, and screw.

1. The relationship between work and power is that power is the rate at which work is done. (P = F – D/T)