# Physics Unit Study Guide (Answer Key)

### Sections 1 – 3: Measuring Motion

- 1) What is a reference point (also called frame of reference)? An object that appears to stay in place
- 2) A change in position relative to a reference point is known as *motion*
- 3) Write the formula for speed. S = D/t
- 4) What is the average speed of a jet plane that flies 7200 km in 9 hours? 800 km/hr
- 5) How is velocity and speed the same? How are they different? *Both measure the distance traveled over a period of time. Velocity adds a direction*
- 6) The rate at which velocity changes over time is *acceleration*
- 7) Write the formula for acceleration (*Final velocity initial velocity*) / *total time*
- 8) Identify the term that describes a decrease in acceleration. *deceleration*

## Section 4: What is Force?

- 1) A *force* is a push or a pull.
- 2) True or False. A force can give energy to an object and cause it to start moving, stop moving, or change direction.
- 3) Identify the force that acts in a direction opposite to the motion of a moving object. *Friction*
- 4) Identify the unit that scientists use when expressing the force of something. *Newtons* (N)
- 5) What is net force? *The combination of all of the forces acting on an object*.
- 6) Are the forces of a kicked soccer ball balanced or unbalanced? How do you know? *Unbalanced, the object is in motion and accelerating*

## Section 5: Friction

- 1) Identify a force that opposes motion between two surfaces that are in contact. *Friction*
- 2) Define kinetic friction. *Friction created from a moving object*
- 3) Define static friction. *Friction created from an object at rest*.
- What type of friction is encountered when you and your friends push a car out of gas into a gas station? *Rolling kinetic friction*
- 5) What type of friction is experienced when you drag your chair to a different table? *Sliding kinetic friction*
- 6) Is friction increased or decreased when you oil the chain on a bike? *decreased*
- 7) Why is friction greater between two surfaces that are rough? *More places to interact and oppose motion (more hills/valleys)*
- 8) Name two ways in which friction can be increased. *Sand, rocks, etc*

# Section 6: Gravity

- 1) Define gravity *Force of attraction between any two objects with a mass*
- 2) Explain the Law of Universal Gravitation. All objects will a mass attract each other and the force of attraction depends upon the mass of the objects and the distance the objects are apart.
- 3) Describe the difference between weight and mass. Weight is a measure of the force of gravity, mass is a property of matter.
- 4) What must you know in order to calculate the gravitational force between two objects? Mass and distance between objects.
- 5) Where would you weigh the most, on a boat, on the space shuttle, or on the moon? A boat, most gravity near Earth
- 6) What is air resistance? *The force that opposes the motion of objects through air*
- 7) Define free fall. *Gravity is the only force acting on an object*
- 8) When does and object reach its terminal velocity? *When air resistance and the force of gravity are balanced*.
- 9) What is the acceleration due to gravity (this is a number)? **9.8** *m/s2* on the surface of Earth
- 10) What are the two components of projectile motion? *Horizontal pushing force and downward pull of gravity*
- 11) Identify the only direction that an object accelerates when in a projectile motion. *Down*. What gives the object its acceleration? *Gravity*

#### Sections 7 -9: Newton's Laws and Momentum

- 1) Explain Newton's First Law. An object at rest stays at rest, an object in motion stay in motion, unless acted upon by an outside force.
- 2) When you ride a bus, why do you fall forward when the bus stops moving? You are still an object in motion and not attached to the bus.
- 3) What is inertia? *The tendency of an object to resist motion*
- 4) How are mass and inertia related? They are both properties of matter and do not change no matter where the object is.
- 5) Write Newton's Second Law. F = ma Force = mass x acceleration
- 6) How does Newton's second law explain why it is easier to push a bicycle than to push a car with the same acceleration? *While the acceleration is the same it takes a greater force to get the massive car up to that acceleration as compared to the easier force to accelerate the bicycle.*
- 7) Write out Newton's Third Law. Every action has an equal and opposite reaction, or all forces come in pairs.
- 8) Use Newton's Third Law to explain how a rocket accelerates. As the rocket fuel pushes out the back the equal and opposite force pushes the rocket into outer space (opposite the direction of rocket fuel)
- 9) Which of Newton's Laws state that forces come in pairs? *Third law*
- 10) What is momentum? The quantity defining the product of the mass and velocity of an object.
- 11) Explain the Law of Conservation of Momentum. *Momentum is conserved before and after a collision occurs*.
- 12) How is Newton's third Law of motion related to the law of conservation of momentum? *The momentum before is equal to the momentum afterwards because every action has an equal and opposite reaction.*

#### Sections 10 – 11: Fluids & Pressure

- 1) Define pressure: *The amount of force per unit area on a surface*
- 2) Define fluid: Non-solid in which the molecules are able to move past each other (gas or liquid)
- 3) Describe how fluids exert pressure. *Fluids exert pressure in all directions*
- 4) What is the SI unit for pressure? *Pascal (Pa)*
- 5) Define atmospheric pressure. *The pressure caused by the weight of the atmosphere*.
- 6) Describe how pressure changes with increasing altitude. *Higher altitude means lower pressure (less air particles)*
- 7) Describe how pressure changes with increasing depth. *Greater depth means higher pressure (more particles on top of you)*
- 8) Give 3 examples of fluids flowing from high pressure to low pressure everyday in your life. Soda, straw, lungs
- 9) When drinking through a straw, ho do you decrease the pressure inside the straw? Create very low pressure in straw to move high pressure liquid up straw to low pressure environment.
- 10) Define buoyant force. The upward force that keeps an object immerse in or floating on a liquid.
- 11) Explain the relationship between fluid pressure and buoyant force. *More pressure at the bottom of an object results in more upward buoyant force*.
- 12) What is Archimedes Principle? The buoyant force of an object on a fluid is an upward force equal to the weight of the volume of fluid that the object displaces.
- 13) What causes an object to buoy up? Buoyant force is greater than the weight
- 14) Name a substance that is less dense than air. *Helium*
- 15) How do ballast tanks affect the buoyancy of a submarine? By adding or removing air you change the density of the object.
- 16) Imagine that your friend tells you that all heavy objects sink in water. Explain why you agree or disagree with this statement. Disagree because while many heavy object sink, if the density of the heavy object is less than the density of water the object will float. Sinking does not simply depend on weight.
- 17) What is Bernoulli's principle? The pressure in a fluid decreases as velocity increases.
- 18) What is lift? An upward force on an object that moves in a fluid
- 19) Define thrust. Pushing or pulling force exerted by an object
- 20) Define drag. Air friction on an object and opposes the direction of air flow.
- 21) How do thrust and drag help an airplane achieve flight? In combination they determine the speed of the object.
- 22) When an airplane is in flight, how does the air pressure above a wing compare with that below the wing? *Above wing=lower*
- 23) What is turbulence? An irregular or unpredictable flow of fluids
- 24) How do airplanes reduce turbulence? Flaps on airplane wings
- 25) What is Pascal's principle? Fluid in a closed system exerts a pressure of equal intensity in all directions