Unit 4 Energy Study Guide – Physics

Name Key
Period ____ Date ____

Vocabulary:

Energy
Kinetic Energy
Potential Energy
Energy Conversion
Joules
Mechanical Energy
Law of Conservation of Energy
Law of Conservation of Momentum
Law of Conservation of Matter
Inelastic Collision
Elastic Collision
Machine
Efficiency
Screw
Wedge
Lever
Wheel & Axle
Inclined Plane
Mechanical Advantage
Work
Power
Momentum
Impulse

Helpful Questions:

1. What is the law of conservation of energy? How does it apply to a roller coaster?
   Energy cannot be created or destroyed, only converted to other forms

2. Describe each of the simple machines and explain why they are effective when doing a certain type of work.

Lever	pulley	Wedge	wheel & Axle	Screw	inclined plane
$\frac{L_r}{L_e}$	$2n$	$\frac{L}{W}$	$\frac{r_w}{r_a}$	$\frac{\pi d}{e}$	$\frac{L_s}{H_r}$

MA =

3. Compare and contrast Kinetic and potential energy (give the definition, give the equations, etc.). How do these apply to the concept of mechanical energy?
   KE = motion, $\frac{1}{2}mv^2$,
   PE = position, mgh,
   PE + KE = ME

4. What is momentum? How do you calculate it? Is the change in momentum of an object greater when an object bounces or when it sticks to the surface? Explain why.
   $p = mv$, momentum is the concept of inertia in motion
   ΔP is ↑ when bouncing!

5. How did Einstein utilize the law of conservation of energy to produce his theory on matter and energy? What is his famous equation developed from this theory?
   $E = mc^2$, conservation of energy → cons of mass

6. How much work is done to lift a 30kg mass to a height of 20 m? How would this amount of force put in compare if the mass were carried up a ramp instead of lifted directly upwards? Does the work change in this case?

$W = F \cdot d \quad 9.8 \cdot 30 \cdot 20 = 5880\text{J}$

7. A toy cart moves with a KE of 40J. What will its kinetic energy be if its speed is doubled?

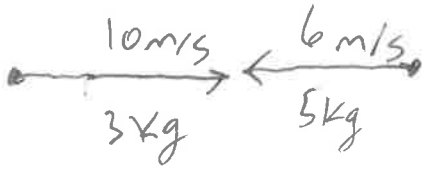
$40\text{J} \rightarrow \frac{1}{2}mv^2 \rightarrow 2^2 = 4$

$40 \times 4 = 160\text{J}$

8. In an inelastic collision, momentum must be conserved but energy does not seem to be conserved. What happens to the overall kinetic energy of a system during an inelastic collision?
   A) The kinetic energy will increase because the mass of the system increases as the objects become connected.
   B) The kinetic energy will remain the same, the proportional loss of velocity accounts for the apparent gain in mass.
   C) The kinetic energy decreases, but the potential energy increased during the collision.
   D) The kinetic energy decreases because energy is used to form the bond connecting the two objects in the collision.

Use the following information to answer questions 9-10. Cart X with a mass of 3 kg is traveling to the right with a speed of 10 m/s in a straight line toward cart Y. Cart Y has a mass of 5 kg and is traveling to the left with a speed of 6 m/s. They collide and become connected through a Velcro® system on their ends.

9. What kind of collision is represented by this example?
   A) Inelastic B) Elastic C) Recombinative D) Ballistic
10. What is the motion of the carts after the collision?
   A) They will move to the right after the collision because cart X's speed is higher.
   B) They will move to the left after the collision because cart Y's mass is greater.
   C) They will stop moving.
   D) They will move off at a 90o angle to each of their original paths at half their original speed.
11. Which cart exerts the greater force during the collision?
   A) Cart X
   B) Cart Y
   C) They both exert an equal force on the other.
   D) Neither exerts a force on the other.



$30\text{kgm/s} = 30\text{kgm/s}$