Name _____

Energy & Work (p. 257 – 265)

I. Work & Energy

School-Work
House work
vs.
Construction
(Manual Labor)

1. Define the term work.

Work – constant force exerted on an object in the direction of motion multiplied by the objects displacement

2. Determine the equation for work using the following steps.

1. Solve Newton's 2nd Law in terms of acceleration.

   $a = F/m$

Pushing against a wall.

Holding vs. lifting a fishing pole

2. Using the equation used to find linear velocity ($v_f^2 = v_i^2 + 2ad$), solve for the following :

   $2ad = v_f^2 - v_i^2$

3. Replace a with F/m and multiply both sides by $m/2$.

   $Fd = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

3. Write out the formula used to determine work.

$W = Fd$ $(= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2)$ $F = mgd$

4. Work is measured in the units N·m **, which is equal to the units** Joules **.**

Road Runner vs. Wile E. Coyote

5. Define the term energy.

Energy – ability of an object to produce a change in itself or the world around it

6. What units are used to measure energy? Joules (1 N moved 1 meter)

7. Define the term kinetic energy.

Energy in motion.

Kinetic Energy – ½ times the mass of an object multiplied by the velocity of the object squared

8. Write out the formula used to determine kinetic energy.

$KE = \frac{1}{2}mv^2$

Avalanche, Baseball, Rolling Car

Styrofoam Ball Demo

9. Define the term work-energy theorem.

Work-Energy Theorem – when work is done on an object, the result is a change in kinetic energy

KE of particles

10. Write out the formula used to determine work in terms of kinetic energy.

$W = \Delta KE = KE_f - KE_i$

Name _____

II. Calculating Work

p. 258

Sun/Planet

1. **If force and direction of motion are at right angles, then work equals zero.**

   Circle One : (True) False (Walking with your lunch tray to your seat)

Weight Lifting → opposite!

2. **If displacement occurs in the x direction, which component does work.**

   Circle One : (X-Component) Y-Component Both p. 259

3. **Write out the formula used to determine work when an angle is involved.**

   $W = Fd(\cos\theta)$

4. **How much work is done by the following force agents?**

   $\cos 90° = 0$ → Gravity = None

   $\cos 90° = 0$ → Normal Force = None

   $\cos 180° = -1$ → Friction = Negative

   Perpendicular to direction of motion. (See question 1.)

5. **How is work calculated when many forces are exerted on a system?**

   1. Calculate work done by each force 2. Add results

III. Power

p. 263

1. **Define the term power.**

   Power – work done divided by the time taken to do the work

100 meter dash (Run vs. Walk)

2. **Write out the formula used to determine power.**

   $P = \frac{W}{t}$ (Work) / (Time)

   (current) (voltage) $P = IV$ → electrical

3. **What units are used to measure power?** watts (1 Joule transferred in 1 sec)

- Running a race
- Tractor pull

4. **Define the term watt.**

   Watt – one joule of energy transferred in one second

1 hp = 746 watts

5. **Power is often expressed in (kW) kilowatts, since a watt is such a small unit to measure.**

   Circle One : (True) False

Common source of power in the 1700's

6. **Write out the formula used to determine power in terms of velocity.**

   $P = Fv$

   1. $P = \frac{Fd}{t}$

   2. $\frac{d}{t} = v$

High
300 = Car
360 = Truck