Name: **Answer Key** Date: _____ Period:_____

Physical Science 1st semester Final Exam Review

Unit 3 (Work, Power, & Machines) and Unit 4 (Energy & Heat)

1. Work (write **yes** or **no** to indicate if work is done in the following situations)
   a. Lifting a book **YES** c. Pushing a shopping cart **YES** e. pushing on a wall **YES**
   b. Carrying a book to your desk **NO** d. Holding weights over your head **NO** f. kicking a ball **NO**
2. Work problems (SHOW WORK)
   a. How much work is done if 25 N of force is used to move a rock 5 m?
      F = 25 N W = F * d → 25N * 5m = **125 J**
      d = 5 m
   b. How high did you lift your 12 N sister if you did 48 J of work?
      W = 48 J d = W/F → 48J/12N = **4 m**
      F = 12 N
   c. If 70 J of work is needed to move an object 15 m what is its weight (force)?
      W = 70 J F = W/d → 70J/15m = **4.67 N**
      d = 15 m
3. What can a machine multiply? **A machine can multiply force.**
4. Mechanical Advantage problems (SHOW WORK)
   a. What is the mechanical advantage of a lever if you apply 14 N of force to lift a car that weighs 1400 N?
      Input Force = 14 N $MA = F_R/F_E$ → 1400N/14N = **100**
      Output Force = 1400 N
   b. What is the mechanical advantage of a ramp that is 250 m long and 50 m high?
      Input distance = 250 m MA = De/Dr → 250m/50m = **50**
      Output distance = 50 m
5. What is efficiency? **Efficiency is the percentage of work input that becomes work output.**
6. Why is the efficiency of a machine always less than 100 percent? **Because there is always some friction.**
7. Give 2 examples of each simple machine:
   a. Inclined plane - **Ramp**
   b. Lever – **See saw, nutcracker, scissors**
   c. Wedge – **Axe, zipper**
   d. Wheel and axle – **Steering wheel**
   e. Screw – **Screwdriver, twist bottle cap**
   f. Pulley – **Flag pole**
8. What is kinetic energy? *(Define and write the formula)* **Kinetic energy is the energy of motion. The formula for Kinetic Energy is: KE = 1/2mv²** ***mass (kg), velocity (m/s)***
9. What is potential energy? *(Define and write the formula)* **Potential energy is energy that is stored as a result of position or height. The formula for Potential Energy is: PE = mgh** ***mass (kg), gravity (9.8m/s²), height (m)***
10. What is the kinetic energy of a 15 kg rock rolling down a hill at 2.5 m/s? (SHOW WORK)
    Givens: *KE = ?* *m = 15 kg* *v = 2.5 m/s*
    $KE = ½*m* v^2$ → $(½)(15kg)(2.5m/s)^2$ = (7.5)(6.25) = **46.88 J**
11. What is the potential energy of a 1.25 kg book sitting on a shelf 4.5 meters high if gravity is 9.8 m/s²? (SHOW WORK)
    Givens: *PE = ?* *m = 1.25 kg* *g = 9.8 m/s²* *h = 4.5 m*
    PE = mgh → $(1.25kg)(9.8\ m/s^2)(4.5m)$ = **55.125 J**
12. Give 2 examples of each of the following types of energy
    a. Chemical: **gasoline, food**
    b. Elastic potential: **rubber band, bungee cord**
    c. Thermal: **bonfire, lit match**
    d. Nuclear: **nuclear power plant, sun, atom**
    e. Mechanical: **riding a bicycle, rowing a boat**
    f. Kinetic: **a cheetah running, a sprinter**
    g. Gravitational potential: **a book on a shelf, a roller coaster at the top of the ride**
    h. Electrical: **blender, radio**

13. What does the law of conservation of energy state? **Energy cannot be created or destroyed.**
14. When does the kinetic energy of a roller coaster increase the most? **At the bottom of the roller coaster.**
15. Where does a pendulum have the most potential energy? **At its highest point.** The most kinetic energy? **At its lowest point.**
16. Define heat: **the transfer of thermal energy from one object to another because of a temperature difference.**
17. Define temperature: **a measure of how hot or cold an object is compared to a reference point.**
18. As the temperature of an object increases what happens to the thermal energy? **The thermal energy increases.**
19. The specific heat of copper is 0.385 J/g°C. What is the energy needed to heat 2.75 g of copper from 14°C to 35°C?
    Givens: *Q = ?* *m = 2.75g* *c = 0.385 J/g°C* *ΔT = 35°C - 14°C = 21°C*
    Q = mcΔT → (2.75g)(is 0.385 J/g°C)(21°C) = **22.23 J**
20. Describe the three ways energy transfers.
    a. Conduction – **the transfer of thermal energy as a result of direct contact (touching); requires matter.**
    b. Convection – **the transfer of thermal energy through fluids such as liquids and gases; requires matter.**
    c. Radiation – **the transfer of thermal energy by waves moving through space; does not require matter.**
21. Which method of energy transfer does not need matter? **Radiation**
22. Which method(s) of energy transfer needs matter? **Conduction and Convection**
23. Define conductor. **A conductor is a material that transfers thermal energy easily. Metals are good conductors.**
24. Give two examples of conductors: **Metals such as copper, silver, gold, and iron.**
25. Define insulator. **An insulator is a material that is a poor conductor because it doesn't transfer thermal energy well. Plastic and wood are good insulators.**
26. Give two examples of insulators: **Rubber, plastic, wood, paper, fleece, fiber glass.**