

1. Define the following terms:

a. Energy

ABILITY to do work (CHANGE OR CAUSE CHANGE)

b. Work

TRANSFER OF ENERGY - APPLY FORCE OVER A DISTANCE

c. Kinetic energy

ENERGY OF MOTION

d. Gravitational potential energy

ENERGY DUE TO OBJ. BEING ELEVATED ABOVE EARTH'S SURFACE

e. Elastic potential energy

ENERGY RELEASED OR STORE WHEN OBJECT DEFORMS

f. Chemical energy

ENERGY STORED IN MOLECULES (BONDS)

g. Power

RATE OF DOING WORK

2. What is the SI unit of work and energy?

JOULE

3. What is the original source of practically all of the energy on Earth?

THE SUN

4. What does the Law of Conservation of Energy state?

ENERGY CAN'T BE CREATED OR DESTROYED,  
ONLY TRANSFORMED

5. If a force is exerted on an object but it does not move, was work done? Why or why not?

NO -  $dist = 0$

$$W = F \cdot d$$

6. What is the formula for calculating gravitational potential energy? Define each variable.

$$GPE = mgh$$

$m = \text{mass}$   
 $g = \text{gravity strength}$   
 $h = \text{height}$

7. If an object has 15 J of potential energy at a height of 50 cm, how much PE will it have if raised to a height of 100 cm?

$$2 \cdot 15J = 30J$$

8. If the object in the previous question is dropped to the ground, how much kinetic energy will it have at the instant before it hits the ground, assuming air friction is so small that we can ignore it?

$$50 \text{ cm} = 15J$$

$$100 \text{ cm} = 30J$$

9. If one object has 200 J of PE when raised to a certain height, how much PE will a second object have at the same height if the second object has half the mass of the first object?

$$\frac{200J}{2} = 100J$$

10. An energy car is elevated to the top of a ramp. What is true about the energy of the car?

$$PE > 0$$

11. The energy car is released from the top of the ramp and rolls down the ramp. What is true about the energy of the car?

PE decreasing  
KE increasing

12. The energy car bounces off a rubber band at the bottom of the ramp and rolls back up the ramp.

- a. How far will the car roll back up the ramp?

less height than release height

- b. Why will it behave in this way (in terms of energy)?

some energy "lost" to system

13. What is the relationship between the work done to an energy car and the speed that it attains on the track?

DIRECT

14. A train traveling at 5 m/s has 10,000 J of KE.

a. How much KE will it have if velocity increases to 10 m/s?

$$KE = \frac{1}{2}mv^2 = 40,000 \text{ J}$$

b. Does doubling the velocity double the KE? Why or why not?

NO! -  $v^2$  means that  $2^2 = 4x$

For any calculation that you show below, carry out these steps:

- Write the **formula** that you will use to solve the problem
- Re-write the formula, substituting known values **with units**
- Write the answer using the proper **unit**
- Check you answer for the proper number of **significant figures**
- Check you work for accuracy

15. A 25.0 kg bicycle is moving at 7.0 m/s. How much kinetic energy does the bicycle have?

$$KE = \frac{1}{2}mv^2 = \frac{1}{2}(25.0 \text{ kg})(7.0 \text{ m/s})^2 = \underline{610 \text{ J}}$$

16. If the bicycle increases its speed to 14 m/s, how much kinetic energy does the bicycle now have?

$$4 \times 610 \text{ J} = 2440 \text{ J} \\ (\underline{2400 \text{ J}})$$

17. Does doubling the velocity of the bicycle double the kinetic energy of the bicycle? Why or why not?

NO! see Q# 14b.

18. What happens to the kinetic energy of the bicycle when it is braked to a full stop?

turns into heat

19. If a 12. kg suitcase is lifted to a height of 2.0 m, how much potential energy does the <sup>suitcase</sup> rock now have?

$$PE = mgh = (12. \text{ kg})(9.8 \text{ N/kg})(2.0 \text{ m}) = 235.2 \text{ N}\cdot\text{m} \\ = 240 \text{ J}$$

20. If the suitcase is dropped to the ground, how much kinetic energy does the suitcase have in the instant before it hits the floor? (assume air friction is so small that we can ignore it)

240 J

21. How much potential energy does the suitcase have when it has fallen halfway to the ground? (again, we can ignore air friction)

120 J

22. For 99% of human history, what was the main source of energy to do work?

muscle

23. What forms of energy made industrialization possible?

fossil fuel, (coal, oil, natural gas)

24. Since 1950, how much has human energy consumption increased?

5x

25. Fill in the blanks below.

