TAKS OBJECTIVE FIVE REVIEW - Electricity, Energy, and Einstein

VI. Energy

- A. Kinetic Energy energy of motion $KE = 1/2mv^2$ units are Joules
- B. Energy can neither be created nor destroyed (conservation of energy), so when you get an energy problem, the total energy must remain constant.
 (ie: if a moving object stops, its KE = 0, but the total energy, the original KE, is changed to other forms of energy heat, friction, potential energy etc.)
- C. KE can be used to do work, since the units for both is **joules**.
- D. Potential energy the potential to do work, or the energy of position.
 - 1. Gravitational potential energy (GPE) is: **GPE = mgh** (mass times gravity times height) units are **joules**
- E. Renewable energy sources: wind, solar, geothermal, hydroelectric These are NOT fossil fuels.
- F. On TAKS you will be asked to evaluate the tradeoffs of using different energy sources.

IX. Electricity

A. Ohm's Law : Voltage in a circuit equals current (amps A) times resistance (ohms W).

V = IR Units: volts

- B. Electrical power equals current (amps) times voltage P = IV units Watts
- C. Electrical energy equals power times time E= Pt units: joules

X. Einstein's equation

A. This equation expresses the equivalence of mass and energy: $E=mc^2$

FORMULA CHART for Grade 11 Science Assessment

$Density = \frac{mass}{volume}$	$D = \frac{m}{v}$
$\left(\begin{array}{c} {\rm heat\ gained\ or} \\ {\rm lost\ by\ water} \end{array}\right) = \left(\begin{array}{c} {\rm mass\ in} \\ {\rm grams} \end{array}\right) \left(\begin{array}{c} {\rm change\ in} \\ {\rm temperature\ } \end{array}\right) \left(\begin{array}{c} {\rm specific} \\ {\rm heat} \end{array}\right)$	$Q=(m)(\Delta T)(C_p)$
$Speed = \frac{distance}{time}$	$s = \frac{d}{t}$
Acceleration = $\frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \frac{v_{\rm f} - v_i}{\Delta t}$
$Momentum = mass \times velocity$	p = mv
$Force = mass \times acceleration$	F = ma
Work = force × distance	W = Fd
$Power = \frac{work}{time}$	$P = \frac{W}{t}$
% efficiency = $\frac{\text{work output}}{\text{work input}} \times 100$	$\% = \frac{W_0}{W_1} \times 100$
Kinetic energy = $\frac{1}{2}$ (mass × velocity ²)	$KE = \frac{mv^2}{2}$
Gravitational potential energy = mass \times acceleration due to gravity \times height	GPE = mgh
$Energy = mass \times (speed of light)^2$	$E = mc^2$
Velocity of a wave = frequency \times wavelength	$v = f \lambda$
Current = voltage resistance	$I = \frac{V}{R}$
Electrical power = voltage × current	P = VI
Electrical energy = power × time	E = Pt

Constants/Conversions		
g = acceleration due to gravity = 9.8 m/s ²		
$c = speed of light = 3 \times 10^{6} m/s$		
speed of sound = 343 m/s at 20°C		
$1 \text{ cm}^2 = 1 \text{ mL}$		
1 wave/second = 1 hertz (Hz)		
1 calorie (cal) = 4.18 joules		
1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)		
newton (N) = kg m/s ²		
joule (J) = Nm		
watt (W) = $J/s = Nm/s$		
volt (V)	ampere (A)	$ohm\left(\Omega ight)$

Use the information and the chart above to solve the following questions

- **1.** Which process best shows the conversion of solar energy to chemical energy?
- **F** Prevailing winds causing windmills to spin
- ${\bf G}$ Green plants making their own food
- H Uranium producing heat to make steam
- ${\bf J}$ Tides generating electricity

- **2.** Which of these is an advantage of producing electricity using solar power plants rather than using coal-fired power plants?
- A Solar power plants can operate for about 10 hours per day.
- **B** Solar power plants can produce variable amounts of energy.
- C Solar power plants produce fewer pollutants.
- **D** Solar power plants require continuous sunlight.



- **3.** What is the approximate difference in gravitational potential energy of the two shaded boxes?
- A 19 J
- **B** 39 J
- C 59 J
- **D** 79 J
- 4. Which of these devices uses the sun's energy directly?
- A Windmill
- B Hydroelectric dam
- C Nuclear power plant
- D Photovoltaic cell
- **5.** A 1-kilogram ball has a kinetic energy of 50 joules. The velocity of the ball is —

F 5 m/s $\,$

- G 10 m/s
- H 25 m/s
- J 50 m/s

6. A company has decided to market itself as environmentally friendly. If the company is going to sell calculators, the use of which energy source would produce the fewest by-products and the least waste?

F Rechargeable batteries G Solar cells H Dry-cell batteries J Tesla coils

- 7. The typical automobile's kinetic energy is converted to heat energy when the brakes are applied. A braking system that converts kinetic energy to electrical energy instead of heat energy has been designed. The electrical energy can be used later to move the car again. How does a system like this benefit the environment?
- F Greater use of solar energy
- **G** Ability to harness wind energy
- H Decreased use of fossil fuels
- ${\bf J}$ Use of renewable hydroelectricity



- 8. What is the potential energy of the rock?
- A 59,900 joules B 64,600 joules C 93,100 joules D 121,600 joules