Energy Lightning Round

1) ENERGY *Multiple Choice* Which of the following is false?  
 W) The higher the octane number, the more pressure the fuel endures before detonation.  
 X) Cetane number measures combustion quality of diesel fuel during compression ignition.  
 Y) When the octane rating is raised by blending ethanol, energy content per percent rises.  
 Z) Isooctane is a reference standard to benchmark the tendency of gas, petrol, or benzin fuels to resist self-igniting.

ANSWER: Y) When the octane rating is raised by blending ethanol, energy content per percent rises.

2) ENERGY *Short Answer* Given that the research octane number is 85 and the motor octane number is 93, find the hypothetical anti-knock index.

ANSWER: 89

3) ENERGY *Short Answer* Name the 4 detectors of the Large Hadron Collider.

ANSWER: ATLAS, ALICE, CMS, LHCb

4) ENERGY *Short Answer* Which device uses a magnetic field to confine a plasma in the shape of a torus?

ANSWER: Tokamak

5) ENERGY *Multiple Choice* Which country has the world’s largest natural gas reserves, second largest coal reserves, and eighth largest crude oil reserves? Also it was the largest producer of crude oil in 2009.  
 W) China  
 X) United States  
 Y) Saudi Arabia  
 Z) Russia

ANSWER: Z) Russia

6) ENERGY *Multiple Choice* The third law of thermodynamics states which of the following?  
 W) If two systems are in thermal equilibrium with a third, then they are in thermal equilibrium with each other.  
 X) The entropy of a perfect crystal approaches zero as temperature approaches absolute zero.  
 Y) Entropy will always rise.  
 Z) Energy can be transformed but never destroyed or created.

ANSWER: X) The entropy of a perfect crystal approaches zero as temperature approaches absolute zero.

7) ENERGY *Multiple Choice* Which law states that the temperature of hot or cold objects progresses toward the temperature of its environment in an exponential fashion? If the rate of heat conduction within them is higher than the heat flow?

W) Newton’s Law of cooling  
 X) Fourier’s Law  
 Y) Ohm’s Law  
 Z) Hesse’s Law

ANSWER: W) Newton’s Law of cooling

8) ENERGY *Short Answer* In either numbers of words, denote which of the following four is true about dark energy.  
 1) It tends to accelerate expansion of the universe.   
 2) It constitutes 73% of total mass-energy in the universe.  
 3) 2 proposed forms of dark energy are the cosmological constant and vector fields.  
 4) Scalar fields which do change in space can be difficult to distinguish from a cosmological constant because change may be extremely fast.

ANSWER: 1 and 2

9) ENERGY *Short Answer* Find the heat taken to change 6 grams of gold at 10 degrees Celsius to 20 degrees in Joules, if the specific heat is 0.13 Joules per gram degree Celsius.

ANSWER: 7.8 Joules (accept 8)

10) ENERGY *Multiple Choice* What is the wavelength at which photosystem 2 of a plant cell best works at?  
 W) 460 nm  
 X) 550 nm  
 Y) 680 nm  
 Z) 720 nm

ANSWER: Y) 680 nm

11) ENERGY *Multiple Choice* Which of the following is true about nuclear fusion?  
 W) Fusion of 2 nuclei with lower masses than iron general absorbs energy.  
 X) Iron, Nickel, and Tin have the largest binding energy per nucleon.  
 Y) Nucleosynthesis is the creation of heavy elements during events like supernovas.  
 Z) Protium undergoes natural fusion in stars.

ANSWER: Z) Protium undergoes natural fusion in stars.

12) ENERGY *Short Answer* Which hydroelectric power plant in Hubei, China, is the world’s largest, producing 22, 500 MW?

ANSWER: 3 Gorges Dam

13) ENERGY *Short Answer* Calculate the displacement (compression) of a spring if a 3-kg object is dropped on it from a height of 4 meters and the spring constant is 60 N/m. Assume the gravity is 10 m/s2.

ANSWER: 2

14) ENERGY *Multiple Choice* Which of the following has the lowest energy efficiency?

W) Wind turbine  
 X) Photosynthesis  
 Y) Muscles  
 Z) Electric heater

ANSWER: X) Photosynthesis

15) ENERGY *Short Answer* Which equation describes the relationship between changes in chemical potential for components in a thermodynamical system?

ANSWER: Gibbs- Duhem equation

16) ENERGY *Short answer* In numbers or words, denote which of the three is false.

1) Renewable energy provides 19% of electricity generation worldwide.  
 2) Iceland, Norway, and Paraguay are powered only by renewable energy.  
 3) Wind turbines have a practical energy efficiency of up to 90%.

ANSWER: 2

17) ENERGY *Short Answer* Which types of cells includes a solid state electrical device that converts the energy of light directly into electricity?

ANSWER: Solar cell

18) ENERGY *Short Answer* Which effect creates voltage or electric current in a material upon exposure to light?

ANSWER: Photovoltaic effect

19) ENERGY *Short answer* In numbers or words, denote which extracetives are removed from wood to free cellulose fibers, which results in black liquor later used as biomass.

1) Lignin  
 2) Hemicellulose  
 3) Sulfur

ANSWER: 1 and 2

20) ENERGY *Short Answer* Denote in numbers of words which of the following is true.

1) Biodiesel is made from vegetable oils and animal fats.  
 2) Ethanol is usually added to gasoline to increase octane.  
 3) Ethanol can be used as vehicle fuel in its pure form.  
 4) Current plant design can’t convert ligning to fuel by fermentation, regarding bioethanol.

ANSWER: 1,2,3, 4 or all

21) ENERGY *Multiple Choice* The Earth has a heat content of around:

W) 10^10 Joules  
 X) 10^20 Joules  
 Y) 10^30 Joules  
 Z) 10^40 Joules

ANSWER: Y) 10^30 Joules

22) ENERGY *Multiple Choice* Who proposed that any differentiable symmetry of action of a physical system has a corresponding conservation law?

W) Hamiltonian  
 X) Newton  
 Y) Lagrangian  
 Z) Noether

ANSWER: Z) Noether

23) ENERGY *Short Answer*

ANSWER: Photovoltaic effect

24) ENERGY *Multiple Choice* Which of the following is true of solar cells?

W) Impurities added to silicon decrease free carriers.   
 X) Pure crystalline silicon is a good conductor of electricity.  
 Y) Doping with boron produces P-type silicon.  
 Z) The resulting silicon from doping is called P-type.

ANSWER: Y) Doping with boron produces P-type silicon.

25) ENERGY *Multiple Choice* The decay of a single U-235 atom produces how many million electron volts?

W) 200   
 X) 300  
 Y) 400  
 Z) 500

ANSWER: W) 200

26) ENERGY *Multiple Choice* Which part of a horizontal axis wind turbine transfers rotational energy into a generator?

W) rotor blades  
 X) shaft  
 Y) nacelle  
 Z) electrical equipment

ANSWER: X) shaft

27) ENERGY *Multiple Choice* Which type of geothermal power plant uses steam directly from geothermal reservoirs to spin turbines and thus generate electricity?

W) Directional steam  
 X) Flash steam  
 Y) Binary cycle  
 Z) Dry steam

ANSWER: Z) Dry steam