

Sci230/Dr Lankar chapter 3: ENERGY and conservation law's ASSIGNMENT

**Note: Power (in Watt) is the amount of energy produce or consumed in 1 second.
So power = energy / time . Energy in joules, time in seconds.**

I. observe the table and answer the questions

OBJECT	FOOD CALORIES in 1g	JOULES in 1 g	COMPARED to TNT
Bullet	0.01	40J	0.015
battery	0.01	40J	0.015
PETN (High tech explosive)	1	4000J	1.6
Chocolate cookies	5	21KJ	11
gasoline	10	42KJ	15
Methane	13	54KJ	20
Fuel cell	26	110KJ	40
meteor	107	450KJ	165
Uranium -235	20 million Cal	84 million J	30 million

A) A cookie (1g) has _____ times more energy than 1 g of TNT. So why can't you blow up a building with TNT ? (think $Ft = \Delta P = \text{change in state of motion} = \text{blowing the building}$)

B) A fuel cell (1g) has _____ times more energy than 1 g of gasoline. The problem with hydrogen is that it takes more volume than gasoline even if it produces more energy. Why scientists think that the hydrogen economy (using hydrogen as fuel and avoiding emission of CO₂) will more appropriate for planes or buses than for cars?

C) According to the table, 1 g of gasoline produces _____ times more energy than 1 g of battery. So it means, if you want to use batteries to run your car (electric car) and still get the same energy that is generated by gasoline, you need a mass of batteries _____ times more important. If you car can carry 10 lbs of gasoline. To get the same potential energy, you will need _____ lbs of batteries ! convert to tons _____. (1 kg = 2 pounds and 1 ton = 1000kg)/.

D)what is the ratio between the energy produced by 1g of uranium and 1g of oil ?
A typical power plant needs 170 tons of oil every year. How many tons of Uranium do yo need? (use the ratio) _____ tons of uranium / plant

E)In France we have about 60 nuclear power plants for 60,000,000 persons.
There are about 300, 000,000 persons in the USA. How many nuclear plants do we need ?
_____ plants
How many tons of uranium will be consumed in 1 year ? (use tons of uranium /plant)

II.Did you know ? KWh is another unit for energy. (look at your electricity bill)

CAn you convert 1 KWh (kilowatt hour) in joule ?

Hint: energy (J) = power (Watt) x time (second) and 1KW=1000W, 1 hour=3600s)

1KWh= _____ J or _____ Cal (1Cal = 4000 J about)

III. horse power was the unit for power in the 19th century. (when the first automobiles were made)
 It is the amount of work a horse can do in one second. 1 horsepower is about 1000W (1000J/s)
 You can illuminate your house (medium one) brightly with 10 bulbs of 100 Watts during 1 second.
 How many horse do you need to do the same job in one second ? (attach the horse to a home made generator that spins a magnet in a coil to produce electricity. Then deal with animal right activist)
 (take 1 horsepower = 1,000 Watt= 1,000 J/s)

IV. The Sun delivers 1KW/m². If you want to use the energy of the Sun to go green and to produce cleanenergy, you have to use cells. You will produce 150W per m². (not 100% efficient).
 A nuclear plant can produce 50 GW (1 Giga = 1000,000,000 so 50GW=5 10¹⁰ W) .
 So if you want to produce 50GW with your solar energy you need to cover an area with cells:
 _____ m²= _____ km² (hint: 1 km² = 1,000,000 m² , so divide)
 = _____ miles² (hint: 1km² = 0.386 mi²) . So this is realistic.

V. watt hour (noted Wh) is another unit for energy. (instead of the usual Physics unit joules)
 1000 watt hour or 1000 Wh is noted 1 KWh (1 kilo watt hour)
1Wh is 1 food calorie (noted Cal)
 Human being produce heat very much like a regular light bulb.
 The energy they deliver in 1 hour is 100 Watt hour or 100Wh
 How much is delivered in 24 hours? How much is that in food calories ?
 does that make sense ? (how many Calories an adult should get ?)

VI. If you bike for 1 hour you spend about 400 Wh that is _____ food calories or _____ cans of coka. (1 can of soda is 200 Calories)
 Most of this energy is lost into heat and only 100 Wh is used efficiently into moving the bike.

VII. 1 m² of solar cells produces 1 KW (1000W) = 1 HORSE POWER.
 To make a solar car you can cover it with solar cells. let s say you cover the car with 1 m² of solar cells. Now, today the solar cells are not yet very efficient. 90% of the energy produced is lost to heat.
 so you are left with only _____ KW to make the engine work. (hint: 10% of 1KW)
 Which is _____ horse power. (hint : 1 horse power = 1 KW)
 Do you think it is now realistic to use solar cars ?
 (hint: a regular car produces 30 horse powers when not driving too fast).

VIII. In a paper on Energy you can read :
 1 barrel of crude oil is 35 gallons or about 135 kg.
 1 barrel (135kg) can produce 5.6 10⁹ J (this is called the EE or energy equivalent).

The article says it took 135 years to use the first trillion barrels of oil and we will use the next trillion in 30 years.

Compute the amount of energy used in 135 years and in 30 years
 (1trillion of barrels = 1000,000,000,000)