Sustainable Energy Resources and Carbon Management

Questions Bank:

Week 1

Lecture: energy conversions, 能源利用及人類問題2-1能源利用及永續發展 slides

Student Name: \_\_\_\_\_\_\_\_\_\_

1. Which of the following statements is **true** (only one):

a. The growth rate of energy consumption has kept pace with GNP growth.

b. Oil use has expanded more than any other fuel since 1940.

c. We reached the point last year where we imported no oil.

d. Electricity use has actually fallen since 1975.

1. Which of the following is a non-renewable resource?
a. uranium b. water c. wind d. biomass e. radiant solar
2. Today, the U.S. imports about what percentage of the oil it uses?

a. 10% b. 25% c. 45% d. 65% e. 80%

1. One of the primary motivating forces behind our per capita reduction in energy use in the 1980’s was \_\_\_\_\_\_\_\_\_\_\_\_\_.

a. a smaller population growth

b. higher oil prices

c. increased nuclear power costs

d. increased domestic oil discoveries

1. The most significant aspect of world consumption of energy over the last 40 years has been the \_\_\_\_\_\_\_\_.

a. growth of nuclear power

b. expanding use of oil

c. increased use of coal

d. emphasis on energy conservation

e. increase in our fossil fuel reserves

1. If you started with $100 in the bank and you had $400 after letting it sit there for 10 years, what would be the annual interest rate you received?

a. 2% b. 7% c. 10% d. 14% e. 22%

1. Continued use of the fuels most relied upon in developing countries will eventually lead to \_\_\_\_\_\_\_\_.

a. depletion of soil nutrients

b. severe thermal pollution of water

c. increased oil prices

d. depletion of coal reserves in those countries

1. If the growth rate of the number of solar collectors is 7% per year, then 1000 units in use in 2010 will grow to \_\_\_\_\_\_\_ units by the year 2040.

a. 1200

b. 2000

c. 4000

d. 8000

e. 20,000

1. The Hubbert curve for an energy resource displays what quantity on the y-axis?

a. time

b. total production

c. yearly production

1. The energy source used most in the U.S. is

a. oil

b. coal

c. water

d. natural gas

Week 2

Lecture: 能源運用概述 slides

Group Study

Student Name: \_\_\_\_\_\_\_\_\_\_

**Energy in Developing Countries
Purpose:** To identify and explore the use of energy in another country and its effect upon the economic and political situation.

Country:

Capital:

Population:

Date:

Growth rate:

% Urban:

% literacy:

Per capita income:

Per capita energy use:

Inflation:

Unemployment:

Principle exports:

Principle imports:

Primary energy fuels used (breakdown into residential/industrial):

Natural energy resources:

Potential fuels for meeting future energy needs:

On this and the next page describe this country’s economic and food situations. Discuss how energy resources play a role in these issues. Mention environmental problems that are particularly troublesome. What changes in the use of energy and economic situation has there been in the last 10-20 years?

Week 3

Lecture: 能量力學 slides

What if corporate average fuel efficiency (CAFE) standards of 40 mpg were mandated for new cars (including sport utility vehicles) beginning in 5 years?

Student Name: \_\_\_\_\_\_\_\_\_\_

1. A net force of 30 newtons is applied to a block of mass 10 kg. The force that must be applied to a block of mass 5 kg to give it equal acceleration is \_\_\_\_\_\_\_\_.

a. 5 N

b. 10 N

c. 15 N

d. 20 N

e. 30 N

1. If a constant non—zero net force is applied to an object, its velocity will certainly \_\_\_\_\_\_\_\_.

a. change

b. stop

c. be zero

1. Which of the following is a unit of energy:

a. watt

b. ft–lb/sec

c. newton/sec.

1. Our nosecracker moved back and forth as shown. The kinetic energy will be greatest at point:

a. *A*

b. *B*

c. *C*

1. For a fossil fueled electrical generating plant, 10,000 Btus of chemical energy input into the plant will result in about how many Btus of waste heat dumped into the environment:

a. 0 Btus

b. 1000 Btus

c. 4000 Btus

d. 6000 Btus

e. 10,000 Btus

1. If a net force of 30 newtons is applied to a cart of mass 3 kg initially at rest, the velocity of the cart at the end of 5 meters will be \_\_\_\_ m/s.

a. 5

b. 10

c. 12

d. 25

e. 30

1. The cost of running a set of eight 100 watt light bulbs for 6 hours, with the cost of electricity at 9¢ per kWh, is approximately:

a. 5¢

b. 24¢

c. 43¢

d. 54¢

e. 72¢

1. A 100 lb sack of potatoes falls from an airplane. As the velocity of fall increases, the air resistance also increases. When air resistance equals 100 lb, the acceleration of the sack will be \_\_\_\_ m/sec/sec.

a. 0

b. 16

c. 32

d. 9.8

e. 24

1. Pumped storage facilities \_\_\_\_\_\_\_\_.

a. increase the overall efficiency of a power plant

b. make use of the output of electricity from photovoltaic cells

c. are used to produce electricity mainly at night

d. have an increase in their potential energy mainly at night

e. cannot be used with a nuclear plant

1. If the energy conversion efficiencies in a 3 step process are 30% for the first step, 40% for the second, and 20% for the third, the overall efficiency (step one to end) is about:

a. 2%

b. 10%

c. 20%

d. 50%

e. 90%

Week 4

Lecture: 能量守恆 slides

Keywords:

Questionnaire 3

Power can be demonstrated by timing students as they run to the top of a flight of stairs. They can each calculate their own power output.

Group Study

Student Name: \_\_\_\_\_\_\_\_\_\_

**Determine Your Own Power**

Stopwatch, tape measure, set of stairs, good sneakers, and bathroom scale

**Introduction: How Much Power Do We Use to Climb a Set of Stairs?**

A force that we all must overcome everyday is that of moving our weight around. The amount of work you do when climbing a set of stairs is equal to the vertical distance that you must lift your body multiplied by your actual weight. This number gives you the amount of work you did in Newton-meters (N · m). Note 1 N · m = 1 Joule (J).

*Note*: Gravity, which, like other forces, is measured in newtons (N), exerts 9.81 N on every 1 kilogram or 2.2 lbs of matter on the Earth's surface.

People can gradually lift their weight to a certain height by climbing a set of stairs. How much time it takes up to climb the stairs is another piece of information we need to solve this activity. By dividing the work done [force (N) × distance (m)] by the time required to do the lifting, you can find out how much **Power** is required for you to climb the stairs. The units for power are Joules/second, and 1 J/s = 1 W (watt).

**Procedure:**

1. Find a stairway and measure the vertical distance from the starting floor to the level of the landing at the top of the stairs.

Vertical Distance (height) = \_\_\_\_\_\_\_\_\_\_ feet = \_\_\_\_\_\_\_\_\_\_ meters
2. Determine your body weight in Newtons.
Mass = (your weight \_\_\_\_\_\_\_\_\_\_ lbs ÷ by 2.2 lbs/kg) × 9.81 m/s2 = \_\_\_\_\_\_\_\_\_\_ Newtons 3. Calculate the amount of work you will be doing.
Weight (N) × Height (m) = Amount of work (N⋅m)
\_\_\_\_\_\_\_\_\_\_ × \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_
4. Measure how much time it takes you to climb the stairs. Time = \_\_\_\_\_\_\_\_\_\_ seconds

5. Calculate how much power it took to climb the stairs.
Amount of work ÷ time = power used
\_\_\_\_\_\_\_\_\_\_ ÷ \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_ Newton meter/second (Watts)
6. Convert the Watts above in item number 5 to horsepower (hp) by dividing it by 746. Your Power in Watts ÷ 746 = \_\_\_\_\_\_\_\_\_\_ hp (*Note*: 746 W = 1 hp)

7. Estimate your vertical kinetic energy to go up the stairs. KE = 0.5\*mass\*velocity^2. Here the vertical velocity is estimated as the height divided by the time.

Week 4 Questions

Student Name: \_\_\_\_\_\_\_\_\_\_

1. What is the minimum work that a motor must do to lift a 70 lb object from the floor to a height of 14 feet?

a. 5 ft-lbs

b. 70 ft-lbs

c. 700 ft-lbs

d. 980 ft-lbs

e. 2010 ft-lbs

1. If the push that you give to a bike is the action force, then the reaction force is \_\_\_\_\_\_\_\_.

a. the force of the bike upon you

b. the weight of the bike

c. the friction force on the tires

d. the acceleration of the bike

e. air resistance on the bike

1. If the height of water behind a dam is increased by a factor of two, then the maximum kinetic energy of the water at the bottom of the dam will increase by a factor of \_\_\_\_\_.

a. one

b. two

c. four

d. zero

1. The net force required to move a body at a constant velocity in outer space is \_\_\_\_\_\_\_\_.

a. zero

b. its weight

c. the force of gravity

d. its mass times its velocity

e. the force of friction

1. A force applied to an object will always cause the object to

a. speed up

b. accelerate

c. change its momentum

d. all of the above

e. none of the above

1. If you shout across a canyon and the echo returns in four seconds, how far away is the other side? (Velocity of sound in air is 300 m/s).

a. 150 m

b. 300 m

c. 600 m

d. 1200 m

e. 2400 m

1. Power is defined as \_\_\_\_\_\_\_\_.

a. the energy used times the time

b. the work done times the distance of motion

c. the energy used divided by the work

d. the rate of converting energy

e. the ability to do work

1. If a 60 kg person is observed to accelerate at a rate of 4 m/sec/sec, the net force responsible for this is:

a. 600 N

b. 240 N

c. 30 N

d. the force of gravity

e. 480 N

1. The “efficiency” of a light bulb is the ratio of the:

a. heat plus electricity produced to the electrical input

b. voltage output of the bulb to the power input

c. energy into the bulb to the energy out of the bulb

d. light output to the electrical energy input

1. How much work is required to increase the velocity of a 4 kg car from rest to 5 m/sec?

a. 10 J

b. 20 J

c. 50 J

d. 100 J

e. 200 J

Week 5

Lecture: 熱與功 slides

Keywords:

Questionnaire 4

Entropy can be illustrated with the diffusion of a drop of black ink in a beaker of water

Student Name: \_\_\_\_\_\_\_\_\_\_

1. Heat is \_\_\_\_\_\_\_\_.

a. a measure of the average kinetic energy of molecules in an object

b. a property of an object

c. the energy transferred between bodies due to a temperature difference

d. the specific heat of an object

1. Heat energy will spontaneously always flow in the direction of \_\_\_\_\_\_\_\_.

a. a higher temperature

b. a lower temperature

c. up, since heat rises

d. a smaller heat capacity

1. What color would you select for a container holding ice cubes such that the ice is preserved the longest?

a. white b. black c. green d. color doesn’t matter

1. Your feet feel warmer on a rug than on a tile floor because the rug

a. is usually warmer than the tile

b. is a better insulator than tile

c. has more internal energy than tile for the same mass

d. all of these

1. At a restaurant you are served coffee before you are ready to drink it. In order that the coffee be the hottest when you are ready for it, when would it be best to add cream (at room temperature) to it?

a. when you are ready to drink it

b. right when you are served the coffee

c. it doesn’t matter, as the final temperature will be the same

1. If the R-value of a wall is 10 ft2- ̊F-hr/Btu, then the rate of heat transfer through a 2 ft × 3 ft section of wall, with Δ*T* = 50°F, will be:

a. 10 Btu/hr

b. 30 Btu/hr

c. 500 Btu/hr

d. 3000 Btu/hr

e. 10,000 Btu/hr

1. Running a clothes dryer for 90 minutes at 800 Watts will cost about \_\_\_\_\_\_ cents if the cost of electricity is 7 cents per kWh:

a . 4

b. 10

c. 24

d. 50

e. 120

1. An object with a high specific heat will \_\_\_\_\_\_\_\_.

a. lose its heat very fast

b. decrease in temperature quite fast if removed from the heat source

c. take considerably more heat to raise its temperature

d. always be water

1. When ice crystals form in the clouds, \_\_\_\_\_\_\_\_.

a. heat energy is released

b. the atmosphere becomes colder

c. phase change from solid to liquid occurs

d. the thermal mass of the atmosphere increases

1. The “R-value” of material is not related to its \_\_\_\_\_\_\_\_.

a. composition

b. area

c. thickness

d. resistance to heat flow

1. The temperatures on an Oswego, New York, “warm” spring day have a maximum of 64°F and a minimum of 30°F. What is the number of heating degree days?

a. 18

b.30

c. 34

d. 47

e. 64

Week 6

Lecture: 家庭能量節約及熱傳控制 slides

Keywords:

Questionnaire 5

Student Name: \_\_\_\_\_\_\_\_\_\_

1. Infiltration in a house will \_\_\_\_\_\_\_\_.

a. increase on windy days

b. raise the heating load by about 10%

c. reduce the number of air changes

d. be increased by caulking around windows

1. The predominant method of heat transfer to a cold drink held in an evacuated bottle (a thermos) is by \_\_\_\_\_\_\_\_.

a. conduction b. convection c. radiation

1. A heat pump will have an efficiency (heat out to electrical in) of about \_\_\_\_\_\_\_\_.

a. 35% b. 50% c. 75% d. 100% e. 200%

1. Since the rate of heat transfer by conduction is proportional to the Δ*T*, what percent savings in your heating bill would you expect if you turned the thermostat down from 75°F to 65°F, and the outside temperature is 25°F?

a. 10% b. 20% c. 30% d. 40% e. 50%

1. The R-value of a piece of material goes up if the material is

a. thicker

b. a better conductor

c. covering a larger area

d. thinner

1. Materials A, B, and C have R-values of 1, 4, and 8 ft2-°F-hr/Btu, respectively. If the rate of heat transfer through material A alone is 20 Btu/hr, then the rate of heat transfer through the combination of A, B and C is \_\_\_\_\_.

a. 1.5 Btu/hr

b. 2.5 Btu/hr

c. 4.0 Btu/hr

d. 7.0 Btu/hr

e. 80 Btu/hr

1. For a furnace to provide 50,000 Btu/hr of thermal energy to a living space, what should the rate of heat supplied by the fuel if the furnace efficiency is 75%?

a. 25,000 Btu/hr

b. 37,000 Btu/hr

c. 50,000 Btu/hr

d. 67,000 Btu/hr

e. 125,000 Btu/hr

1. The cooling effect in a refrigerator is produced by \_\_\_\_\_.

a. the electric motor which essentially converts electricity into heat

b. compression of the refrigeration gas into a liquid

c. liquefying the refrigeration gas

d. vaporization of the refrigeration liquid

e. proper insulation

1. Which of the following situations would be allowed by the second law of thermodynamics?

a. running of a heat engine using temperature differences in the oceans

b. converting 100 joules of heat energy into 100 joules of work

c. passage of heat from the freezer into the refrigerator section

d. the reduction of waste heat from a power plant to zero with better technology

1. A heat engine \_\_\_\_\_\_\_\_.

a. converts work into heat energy

b. needs a temperature difference to be able to work

c. can be 100% efficient in the absence of friction

d. needs electricity to be able to run

1. Coffee will cool faster when put into a saucer due to increased

a. conduction

b. evaporation

c. condensation

d. a and b

e. b and c

Week 7

Lecture: 太陽能：特性和加熱 slides

Keywords:

Questionnaire 6

Student Name: \_\_\_\_\_\_\_\_\_\_

1. The measure of the position of the sun from the horizontal is called the \_\_\_\_\_\_\_\_.

a. altitude b. azimuth c. declination d. insolation

1. If the insolation upon a flat plate collector is 800 Btu/ft2/day, how large must the collector be to provide 30,000 Btu/hr of thermal energy for an entire day? Take the efficiency of the collector to be 50%.

a. 150 ft2 b. 750 ft2 c. 1800 ft2 d. 4000 ft2 e. 7200 ft2

1. The optimum angle of tilt (from the horizontal) for a flat plate collector at 35° N latitude for the purpose of space heating is \_\_\_\_\_\_\_\_.

a. 0° b. 25° c. 35° d. 45° e. 75°

1. A Trombe wall in a house uses a large window and \_\_\_\_\_\_.

a. R-19 insulation in the walls

b. a vertical thermal mass across the room from the window

c. a vertical thermal mass close to the window

d. a slate floor by the window

e. a vertical flat plate collector using water

1. The use of thermal mass on a direct gain passive solar system \_\_\_\_\_\_\_.

a. reduces temperature fluctuations during the day.

b. provides foundation support for the collector superstructure

c. increases the insolation on the south-facing windows

d. increases temperature fluctuations during the night

1. During which season will more insolation be delivered to a vertical south-facing window on a clear day?

a. winter b. fall c. spring d. summer e. depends upon the R-value

1. One advantage of using air as the working fluid in a solar collector is \_\_\_\_\_\_\_\_.

a. that freezing will not be a problem

b. that water heats up faster than air

c. a smaller storage facility can be used

d. that one needs hot water for showers

1. Commonly used units for solar energy input are

a. watts b. watts/day c. watts/day/m2 d. Btu e. Btu/ft2/day

1. Water circulates in a thermosiphon, hot water system because \_\_\_\_\_\_\_\_.

a. a pump is used

b. gravity causes water to flow from the top of the collector to the bottom

c. hot water is less dense than cold water

d. solar energy is used to run the circulating pump

1. One can increase the insolation upon a one ft2 horizontal plate by \_\_\_\_\_\_\_\_.

a. using a fresnel lens of one ft2

b. using two 1 ft2 fresnel lenses, one on top of the other

c. adding reflectors around the plate

d. increasing the temperature of the plate

e. increasing the absorption of the plate

1. Solar energy is quite compatible for a major part of the U.S. because our major energy needs are for \_\_\_\_\_\_\_\_ energy.

a. electrical b. thermal c. kinetic d. potential e. mechanical

1. An effective way to passively cool a house is to \_\_\_\_\_\_\_.

a. open all the windows

b. use a light colored roofing material

c. use concentrating collectors to provide air conditioning

d. add more insulation on the south side of the house

e. use thermal storage mass

Week 8

Exam (50 minute or 70 minute?)

來自化石燃料的能量, need to go over measurements to perform, designing of experiments

Week 9

Exam work through and 來自化石燃料的能量

Student Name: \_\_\_\_\_\_\_\_\_\_

1. Which of the following air pollutants is emitted in about equal amounts by stationary and mobile sources?

a. particulates

b. carbon monoxide

c. sulfur dioxides

d. hydrocarbons

e. nitrogen oxides

1. Which of the following air pollutants is emitted mainly by the automobile?

a. particulates

b. carbon monoxide

c. sulfur dioxides

d. hydrocarbons

e. nitrogen oxides

1. Increases in the temperature of the earth due to the greenhouse effect over the last 50 years is least due to \_\_\_\_\_\_\_\_.

a. burning of oil by industry and utilities

b. flatulence by cows

c. addition of hot water to lakes by utilities

d. clearing land for farming

e. use of freons

1. The emissions of particulates due to the burning of coal can be reduced by the use of \_\_\_\_\_\_\_\_.

a. electrostatic precipitators

b. scrubbers

c. coal from strip mines of the Western US

d. limestone

e. catalytic converters

1. A balloon is buoyed up with a force equal to the

a. density of the surrounding air

b. atmospheric pressure

c. weight of the balloon and its contents

d. weight of the air it displaces

1. If the volume of an object were to be halved with the same mass, its density would

a. halve b. double c. stay the same

1. If an object was cut in half, its density would

a. halve b. double c. stay the same

1. Your largest personal contribution to global warming in a year comes from \_\_\_\_\_\_\_\_.

a. use of freon propellants

b. use of air conditioners in your home

c. driving your car

d. cutting down trees

e. burning natural gas for home heating.

1. One of the major economic problems in less developed countries is \_\_\_\_\_\_\_\_.

a. deforestation

b. neglected use of solar energy

c. dependence upon imported oil

d. increased emission of greenhouse gases.

1. One of the changes experienced by a body of water when waste heat is added from a power plant is \_\_\_\_\_\_\_\_.

a. an increase in water’s capacity to hold oxygen

b. an increased spawning success for fish

c. an increased biological growing season

d. decreased eutrophication

Week 10

Lecture: 電磁理論及發電, TSMC case study slides, WindHydroThermalAlternatives

Keywords:

Questionnaire 7

“If coal-fired power plant emissions of sulfur dioxide were mandated to be reduced by a factor of 2, what would be the consequences?”

Two pieces pulled up will repel each other, one tape placed on top of another and then the unit pulled up from the table, and the two then pulled part, will show attraction.

Student Name: \_\_\_\_\_\_\_\_\_\_

1. One of the fundamentals of static electricity is that the force between two charges of like charge

a. is attractive b. is repulsive c. is neutralized d. is zero

1. How much current is drawn by a 1500 W appliance operating at 120 V?

a. 2 amps b. 8 amps c. 12 amps d. 15 amps e. 24 amps

1. What quantity is the same for three resistors in a parallel circuit?

a. power b. resistance c. voltage across them d. current

1. A 100 ohm and a 150 ohm resistor are connected in parallel to a 120 V source. What is the current through the 150 ohm resistor?

a. 0.5 amps b. 0.8 amps c. 1.2 amps d. 1.8 amps e. 2.0 amps

1. Cosmic rays impinging upon the earth will generally \_\_\_\_.

a. be deflected by the earth’s gravitational field

b. not be affected if they are electrically neutral

c. be weaker in intensity at the earth’s poles

d. lead to lightning discharges in the atmosphere

1. Pumped storage generally will enable a utility to \_\_\_\_\_\_\_.

a. increase the efficiency of their electrical generating system

b. store energy until the demand is high enough

c. raise electrons to higher energy states

d. increase their electrical potential energy

1. Alternating current has an advantage over direct current because \_\_\_\_\_\_\_\_.

a. one can step up the voltage that one can use

b. batteries can be displaced in most circuits

c. electrical generators can be made to function

d. incandescent lights will only work with AC

1. The largest share of renewable energy in the U.S. comes from

a. wind b. natural gas c. hydro d. petroleum e. radiant solar

1. Superconductors have a primary advantage in that they will \_\_\_\_\_\_\_.

a. reduce heating losses in transmission lines

b. provide large magnetic fields for levitation

c. be able to conduct more current

d. allow electric motors to run almost forever

1. Revenue from a 10 MWe electrical power plant over 24 hours when electricity is sold at 7¢/kwh will be about:

a. $1,700 b. $17,000 c. $34,000 d. $340,000 e. $700,000

1. The fuel that provides most of the electricity in the U.S. is \_\_\_\_\_\_\_\_.

a. oil b. natural gas c. coal d. uranium e. solar

1. Static charge can build up quickly on an object \_\_\_\_\_\_\_\_.

a. during days when the conditions are not humid

b. when the object is in good electrical contact with the ground

c. only when it is in contact with a good conductor

d. only when the object is moving

Week 11

Questionnaire 8

Class time is reserved for project

Week 12

Lecture: 空氣污染及能量運用

Keywords:

Questionnaire 9

Student Name: \_\_\_\_\_\_\_\_\_\_

1. Electricity is transmitted from power plants at \_\_\_\_\_\_\_\_.

a. high voltages b. high currents c. low resistances d. low power

1. If a 20 ohm and a 40 ohm resistor are wired in parallel to a 20 V source, what will be the current in the 40 ohm resistor?

a. 0.33 amps b. 0.5 amps c. 1.0 amps d. 2.0 amps e. 3.0 amps

1. If a 20 ohm and a 40 ohm resistor are wired in series to a 20 V source, the current through the 40 ohm resistor will be:

a. 0.33 amps b. 0.5 amps c. 1.0 amps d. 2.0 amps e. 3.0 amps

1. How much current will be drawn by a 1200 watt hair dryer operating at 120 volts?

a. 0.1 amps b. 1.0 amps c. 1.44 amps d. 10 amps e. 20 amps

1. What will be the approximate cost of running a 2 watt clock for one week when electricity costs 8¢ per kWh?

a. 0.1¢ b. 3¢ c. 11¢ d. 16¢ e. 115¢

1. The electrical force between two particles of unlike charge will be \_\_\_\_\_\_\_\_.

a. repulsive b. attractive c. zero

1. A bird sitting on a bare high voltage wire is not electrocuted because

a. of the high resistance of its body

b. there is no electrical potential difference across its body

c. its body is at a low electrical potential compared to the wire.

d. the high voltage across its feet produced a small current

1. The magnetic field of a bar magnet is similar to that produced by \_\_\_\_\_\_\_\_.

a. a current carrying wire shaped like a coil

b. a horseshoe magnet

c. a straight current carrying wire

1. One of the possible dangers of EMF’s are \_\_\_\_\_\_\_\_.

a. radio system interference

b. their potential to produce a shock

c. biological effect of small magnetic fields

d. electrocution

1. A device which transforms electrical energy into mechanical energy is a \_\_\_\_\_\_\_\_\_.

a. magnet b. transformer c. generator d. motor

1. A transformer can only operate if \_\_\_\_\_\_\_\_\_.

a. the power in equals the power out

b. the potential difference is large enough

c. a.c. is used

d. we step up the voltage

Week 13

Lecture: 溫室效應及熱污染 slides

Keywords:

Questionnaire 10

Make time for students to work together in class to prepare presentation slides for project.

Week 14

Lecture: 來自太陽能、風力和水力的電力 slides

Keywords:

Questionnaire 11

Oops repeated

One needs to understand the pricing of electricity. You should know whether time of day metering is used in your area, the cost per kWh of electricity (for both generation and distribution), and the percent contributions of resources used by your local utility.

Student Name: \_\_\_\_\_\_\_\_\_\_

1. The measure of the position of the sun from the horizontal is called the \_\_\_\_\_\_\_\_.

a. altitude b. azimuth c. declination d. insolation

1. If the insolation upon a flat plate collector is 800 Btu/ft2/day, how large must the collector be to provide 30,000 Btu/hr of thermal energy for an entire day? Take the efficiency of the collector to be 50%.

a. 150 ft2 b. 750 ft2 c. 1800 ft2 d. 4000 ft2 e. 7200 ft2

1. The optimum angle of tilt (from the horizontal) for a flat plate collector at 35° N latitude for the purpose of space heating is \_\_\_\_\_\_\_\_.

a. 0° b. 25° c. 35° d. 45° e. 75°

1. A Trombe wall in a house uses a large window and \_\_\_\_\_\_.

a. R-19 insulation in the walls

b. a vertical thermal mass across the room from the window

c. a vertical thermal mass close to the window

d. a slate floor by the window

e. a vertical flat plate collector using water

1. The use of thermal mass on a direct gain passive solar system \_\_\_\_\_\_\_.

a. reduces temperature fluctuations during the day.

b. provides foundation support for the collector superstructure

c. increases the insolation on the south-facing windows

d. increases temperature fluctuations during the night

1. During which season will more insolation be delivered to a vertical south-facing window on a clear day?

a. winter b. fall c. spring d. summer e. depends upon the R-value

1. One advantage of using air as the working fluid in a solar collector is \_\_\_\_\_\_\_\_.

a. that freezing will not be a problem

b. that water heats up faster than air

c. a smaller storage facility can be used

d. that one needs hot water for showers

1. Commonly used units for solar energy input are

a. watts b. watts/day c. watts/day/m2 d. Btu e. Btu/ft2/day

1. Water circulates in a thermosiphon, hot water system because \_\_\_\_\_\_\_\_.

a. a pump is used

b. gravity causes water to flow from the top of the collector to the bottom

c. hot water is less dense than cold water

d. solar energy is used to run the circulating pump

1. One can increase the insolation upon a one ft2 horizontal plate by \_\_\_\_\_\_\_\_.

a. using a fresnel lens of one ft2

b. using two 1 ft2 fresnel lenses, one on top of the other

c. adding reflectors around the plate

d. increasing the temperature of the plate

e. increasing the absorption of the plate

1. Solar energy is quite compatible for a major part of the U.S. because our major energy needs are for \_\_\_\_\_\_\_\_ energy.

a. electrical b. thermal c. kinetic d. potential e. mechanical

1. An effective way to passively cool a house is to \_\_\_\_\_\_\_.

a. open all the windows

b. use a light colored roofing material

c. use concentrating collectors to provide air conditioning

d. add more insulation on the south side of the house

e. use thermal storage mass

Week 15

Student Presentations or 綠色清潔生產

Biomass discussion?

Student Name: \_\_\_\_\_\_\_\_\_\_

1. The largest component of municipal solid waste in the U.S. is

a. glass b. plastics c. paper d. yard waste e. metals

1. One of the larger problems in municipal recycling programs is

a. public awareness

b. finding markets for materials

c. net energy used in recycled material preparation

d. declining number of landfills

1. One of the least environmental concerns with incineration of waste is

a. emission of dioxins

b. particulate emissions

c. heat addition to rivers

d. metal concentrations in ash

1. A primary resource used for the production of alternate fuel for vehicles is

a. biogas b. corn c. municipal solid waste d. wood products

1. Anerobic digestion for biomass production takes place under conditions of

a. no oxygen

b. high temperatures

c. strong acidity for dissolving waste

1. Energy used for production of ethanol from corn is \_\_\_\_\_than the energy output.

a. more b. less c. the same

1. An efficient wood-burning stove has an advantage over an open fireplace primarily because

a. combustion air intake is limited

b. higher temperatures are reached

c. creosote buildup is reduced

d. most heat transfer occurs by radiation

1. Today most American cars use a fuel mixture of \_\_% ethanol.

a.0 b.10 c.20 d.40 e.90

Week 16

Student Presentations and wrap up, Renewable Energy and Sustainable Design Slides

Week 17

物質的基礎：原子及原子核

Student Name: \_\_\_\_\_\_\_\_\_\_

1. The majority of the radiation emitted to the general public in the normal operation of a nuclear plant comes from the \_\_\_\_\_\_\_\_.

a. cooling water discharged to a lake or a river.

b. reactor core directly.

c. spent fuel rods stored on site.

d. fission fragment gases vented to the atmosphere.

e. low level wastes shipped from the plant

1. The average radiation dose received from radon in the home is \_\_\_\_\_\_\_\_.

a. less than a dental x-ray dose.

b. comparable to that from a nuclear plant

c. very dependent upon local geology

d. larger in older homes

1. At 9 a.m. on Monday a radioactive sample contained four million nuclei. At 9 a.m. on Friday three million of these nuclei had decayed. The half-life of this sample is:

a. 5 days b. 4 days c. 3 days d. 2 days e. 1 day

1. For the same energy, the most penetrating type of radiations in human tissue are \_\_\_\_\_\_\_\_.

a. alpha particles b. beta particles c. gamma rays

1. In the following fission reaction, the atomic number and mass of nucleus Y are: $n+\rightarrow ++2n$.

a. 37, 100 b. 37, 102 c. 38, 102 d. 39, 99 e. 39, 100

1. The reason a nuclear reactor will not explode like a bomb is because \_\_\_\_\_\_\_\_.

a. the uranium-235 enrichment is too low.

b. there is not enough uranium-238 present.

c. the cooling water will always take away the heat.

d. there are control rods present.

e. ...nonsense! It can explode like a bomb in the event of a loss of coolant accident

1. The two purposes of water in a reactor core are \_\_\_\_\_\_.

a. neutron absorber and heat transfer liquid

b. neutron moderator and heat transfer liquid

c. neutron moderator and neutron absorber

d. neutron absorber and lubricant

e. neutron moderator and radiation shield

1. The Emergency Core Cooling System is used in the event of an accident to \_\_\_\_\_\_\_\_.

a. stop the fission reactions

b. reduce fuel rod temperatures

c. provide backup power to control rods

d. change the decay heat of the fuel pellets

1. Fission and fusion reactions have in common \_\_\_\_\_\_\_.

a. absorption of energy in the nuclear reaction

b. high temperature requirements

c. liberation of neutrons

d. loss of mass of products over reactants

e. gain in mass of products over reactants.

1. The best way to reduce your radiation dose from a Co-60 gamma emitting source is to \_\_\_\_\_\_\_.

a. reduce the temperature of the source

b. move twice as far away

c. spend half the time near the source

d. double the thickness of wood between you and the source

e. nonsense! You cannot change the potential dose

1. If a light-weight stable nucleus has 12 neutrons, the atomic mass is expected to be about:

a. 6 amu b. 12 amu c. 18 amu d.24 amu e. 36 amu

1. Exceedingly high temperatures are needed in a fusion reactor because \_\_\_\_\_\_\_.

a. electrostatic barriers must be overcome

b. the fuel must be ionized

c. combustion needs heat to occur

d. water must be boiled and pressurized.

Week 18

Spring Break

Environmental Chemistry – Manahan …

Some other resources:

<https://phet.colorado.edu/en/simulations/filter?locale=zh_TW> – maybe high school appropriate

<https://sciplus.com> – Fresnel lens

Other Activities – This activity succeeds by getting students to work together and calculate the cost of leaving lights on over a weekend in the bathrooms.