**Energy Transformations Review:**

1. Chemical and nuclear energies are examples of what type of energy?

A. Heat B. Kinetic C. Electrical D. Potential E. Thermal F. Light

2. Which of the following is the best description of potential energy?

A. Energy of a moving mass

B. Flow of thermal energy from a hot object to a cold object

C. Energy stored within a spring

D. The energy of objects due to their relative position

3. A natural gas power plant uses the combustion of natural gas to produce electricity. Which of the following is true?

A. The combustion of natural gas releases energy and is therefore endothermic.

B. The combustion of natural gas absorbs/consumes energy and is therefore endothermic.

C. The combustion of natural gas releases energy and is therefore exothermic.

D. The combustion of natural gas absorbs/consumes energy and is therefore exothermic.

4. What is the function of the moderator in a nuclear reactor core?

5. What is the function of the control rods in a nuclear power plant?

6. Explain why control rods are not required in a coal fired power plant.

7. Give three advantages of nuclear power over coal power.

8. Give three advantages of coal power over nuclear power.

9. Give three reasons nuclear power generation is declining.

10. Describe two methods of power generation that have potential to replace coal and nuclear power.

11. Which of the following describes what happens to the molecules of a substance as it heats up? More than one may apply.

A. The molecules will speed up.

B. The molecules will get hotter.

C. The kinetic energy of the molecules increases.

D. The chemical potential energy of the molecules will increase.

E. The spaces between the molecules will increase in size.

F. The number of molecules will increase.

G. The molecules will eventually melt.

12. A piece of solid zinc metal is placed into a beaker containing 400mL of 1.0M sulfuric acid. The amount of acid is more than enough to completely submerge the zinc.

A. Write the balanced equation for the reaction that results including energy in standard form.

B. Is the reaction endothermic or exothermic?

C. Describe three changes you could make to increase the rate of the reaction.

D. For each of the answers in C, explain why using collision theory.

Energy



Reaction Progress

30kJ

22kJ

10kJ

13. Use the above energy diagram to answer the questions below:

A. Is the reaction endothermic or exothermic?

B. Is there more chemical energy in the reactants or the products?

C. This reaction occurs in a small beaker in a science classroom. If you were to hold the beaker in your hand during the reaction, describe what you would feel.

D. Does this reaction release energy to the surroundings or absorb energy from the surroundings?

E. Doe the reactants or the products have more kinetic energy?

F. Would this reaction tend to make the surroundings warmer or cooler?

G. Would stirring the chemicals speed up or slow down this reaction?

H. How much energy is stored within the activated complex?

I. How much energy is absorbed/released (circle one)?

J. What is the ΔH for this reaction?

K. What is the activation energy for this reaction?

L. What is the activation energy for the reverse reaction?

14.     Draw the potential energy (PE) diagram showing the successful collision of the exothermic reaction:

***2 H2    +    O2       →        2 H2O   +  80 KJ***

        The PE of the reactants = 100 KJ

        The activation energy of the forward reaction =  30 KJ

15.     Draw the PE diagram showing the successful collision of the endothermic reaction:

***XY   +   90 KJ   →       X + Y***

        The PE of the reactants = 300 KJ

        The Activation Energy in the forward direction =  200 KJ

16. Magnesium hydroxide and chromic acid react to form magnesium chromate and water, releasing 120KJ of energy. The energy of the reactants was 680kJ and the reaction had an activation energy of 40kJ.

A. Write a balanced chemical equation using delta-H notation.

B. Draw the energy level diagram.

C. Classify the reaction in two ways.

Energy

Reaction Progress

500kJ

410kJ

200kJ



17. Use the above energy diagram to answer the questions below:

A. Is the reaction endothermic or exothermic?

B. Is there more chemical energy in the reactants or the products?

C. This reaction occurs in a small beaker in a science classroom. If you were to hold the beaker in your hand during the reaction, describe what you would feel.

D. Does this reaction release energy to the surroundings or absorb energy from the surroundings?

E. Doe the reactants or the products have more kinetic energy?

F. Would this reaction tend to make the surroundings warmer or cooler?

G. Would stirring the chemicals speed up or slow down this reaction?

H. How much energy is stored within the activated complex?

I. How much energy is absorbed/released (circle one)?

J. What is the ΔH for this reaction?

K. What is the activation energy for this reaction?

L. What is the activation energy for the reverse reaction?

18. Write the following reactions in ΔH notation.

A.        A + B + 500 kJ   →       C + D

  B. CuCl2 + MgO → CuO + MgCl2 + 36kJ

C. C5H12 + O2 → CO2 + H2O + 45 000kJ

D. 2KI + Cl2 → 2 KCl + I2 + 423kJ

19. Write the following reaction in Standard Notation.

           A.   H2    +    I2       →        2 HI      ΔH =  -250 kJ

  B. 2NI3   +   3BaCl2   →    2NCl3    +    3BaI2 ΔH =   175 kJ

  C.2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2 ΔH = -229 MJ

20. 2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2 ΔH = -229 MJ

A. What has more kinetic energy, the molecules of the reactants, or the molecules of the products? How much?

B. What has more mass, the molecules of the reactants, or the molecules of the products? How much?

**Draw the potential energy diagram for reactions 21-22.**

21.                               Potential energy of reactants =                       450 kJ

                                    Potential Energy of activated complex =        520 kJ

                                    Potential Energy of the products =                  300 kJ

a) How does the potential energy change as the reaction proceeds?   

b) How does the kinetic energy change as the reaction proceeds?      

c) Is the reaction exothermic or endothermic?

d) What is the value of   ΔH?

If a catalyst was added, what would happen to the energies of the:

e) Reactants?                                                                                       

f) Products?                                                                                         

g) Activated Complex?                                                                                   

h) If a catalyst was added would the reaction require more or less time to reach completion?

22.                              Potential energy of reactants =                        80 kJ

                                    Activation Energy =                                        100 kJ

                                    Potential Energy of the products =                  140kJ

a) How does the potential energy change as the reaction proceeds?

b) How does the kinetic energy change as the reaction proceeds?

c) Is the reaction exothermic or endothermic?

d) What is the value of ΔH?

If the concentration of the reactants was increased, what would happen to the energies of the:

e) Reactants?

f) Products?

g) Activated Complex?

h) What would happen to the reaction rate?

23.  Use the energy diagram below and identify each of the following. Choose from:

*ΔH, Ea (forward, uncatalyzed), Ea (reverse, uncatalyzed), Ea (forward catalyzed),*

*Ea (reverse, catalyzed), Energy of products, Energy of reactants,*

*Energy of activated complex (catalyzed), Energy of activated complex (uncatalyzed)*

Energy

Reaction Progress



a

b

c

d

e

f

g

h

i

**Nuclear Reactions**

24. A nuclear fission reaction is used to generate thermal energy to produce high pressure steam in a nuclear reactor.

A. Is this reaction endothermic or exothermic?

B. Is there more nuclear potential energy within the products or the reactants?

C. What has more mass the products or the reactants?

25. A nuclear fusion reaction occurs within a star. In this reaction the mass of the reactants is 140.78kg. The mass of the products is 139.92kg.

A. Is the reaction endothermic or exothermic?

B. How much energy is absorbed/released (circle one)?

C. What is the ΔH for the reaction?

26. A high energy neutron causes the fission of carbon-11 into hydrogen-2 and boron-10. The reaction absorbs 2.4nJ of energy.

A. Write the nuclear equation using proper notation, including the energy.

B. Is this reaction endothermic or exothermic?

C. Does the reaction release any neutrons?

D. Is there any danger of this becoming a runaway chain reaction? Explain.

E. How much mass is lost/gained in the reaction?

27. In a nuclear reactor Uranium-235 is induced to fission by a high energy neutron. The fission produces rubidium-96 and Cesium-137 and…

A. Write the nuclear equation for this reaction. Determine what else is produced in this reaction.

B. Every second the reactor fissions 1.200kg of uranium using 0.005kg of neutrons. The total mass of the products is 1.203kg. How much energy is released per second in this reactor?

28. Describe two problems with wind power.

29. Describe two problems with solar power.

**Energy Transformations Review:**

1. Chemical and nuclear energies are examples of what type of energy?

D. Potential

2. Which of the following is the best description of potential energy?

D. The energy of objects due to their relative position

3. A natural gas power plant uses the combustion of natural gas to produce electricity. Which of the following is true?

C. The combustion of natural gas releases energy and is therefore exothermic.

4. What is the function of the moderator in a nuclear reactor core? To slow down the emitted neutrons so that they can stimulate the fission of another nucleus.

5. What is the function of the control rods in a nuclear power plant? To absorb neutrons to control the rate of fission and prevent a meltdown.

6. Explain why control rods are not required in a coal fired power plant. The reaction in a coal plant is not a nuclear reaction. You can simply adjust how much coal is added to adjust the amount of energy produced.

7. Give three advantages of nuclear power over coal power.

Almost zero air pollution.

Uses much less fuel.

Need to mine less material for fuel.

Need to transport less fuel

Much more energy can be generated from a single power plant

8. Give three advantages of coal power over nuclear power.

No nuclear waste produced

Much cheaper to build and operate

If the plant fails (explodes), much less damage is done

No risk of a meltdown

9. Give three reasons nuclear power generation is declining.  
 Fears that smaller countries can develop nuclear weapon technology from nuclear power tech

Fear surrounding terrorist attacks

Fear surrounding dangers of meltdown

Environmental concerns around disposal of nuclear waste (radioactive materials)

10. Describe two methods of power generation that have potential to replace coal and nuclear power.

* Hydroelectricity. Using dams to block rivers and create large bodies of water (essentially a lake). The water is then released in a controlled manner and the rushing water is used to spin a turbine. Once the dam has been built (which is very environmentally destructive) the energy produced is nearly pollution free, and is relatively inexpensive.
* Wind Power. Wind power is inexpensive after the initial building of the wind turbines. Wind power is, unfortunately, intermittent; it only works when it is windy!
* Geothermal. Uses the extreme heat inside of the Earth. This energy is not easily accessed. Only certain places on Earth have access- where there are volcanoes or hot springs…
* Solar. Expensive and difficult to generate high voltage flow needed for transporting electricity over long distances.

11. Which of the following describes what happens to the molecules of a substance as it heats up? More than one may apply.

A. The molecules will speed up.

C. The kinetic energy of the molecules increases.

E. The spaces between the molecules will increase in size.

12. A piece of solid zinc metal is placed into a beaker containing 400mL of 1.0M sulfuric acid. The amount of acid is more than enough to completely submerge the zinc.

A. Zn + H2SO4 → ZnSO4 + H2 + energy

B exothermic

C. Increase Temperature; Increase the concentration of the acid; Stir the acid; Add a catalyst; Break the zinc into small pieces.

D. Increase Temperature-molecules are moving faster and therefore with have more collisions and each collision will have a higher average energy.; Increase the concentration of the acid- more collisions; Stir the acid molecules are moving faster and therefore with have more collisions and each collision will have a higher average energy.; Add a catalyst- lowers the activation energy, higher percentage of collisions will be successful; Break the zinc into small pieces- more surface are of zinc means more zinc atoms can collide therefore more collisions.

Energy



Reaction Progress

30kJ

22kJ

10kJ

13. Use the above energy diagram to answer the questions below:

A. endothermic

B. products

C. The beaker would get cold

D. absorb energy from the surroundings

E. reactants

F. cooler?

G. speed up

H. 30kJ

I. 12kJ absorbed

J. 12kJ

K. 20kJ

L. 8kJ

14.

Energy

130kJ

100kJ

20kJ

Reaction Progress



2H2 + O2

2H2O

15.

Energy

500kJ

X+Y

390kJ

XY

300kJ

Reaction Progress

16. Magnesium hydroxide and chromic acid react to form magnesium chromate and water, releasing 120kJ of energy. The energy of the reactants was 680kJ and the reaction had an activation energy of 40kJ.

A. 1Mg(OH)2 + 1 H2CrO4 → 2 H2O + 1 MgCrO4 ; ΔH= -120kJ

B.

720kJ

Energy

680kJ



560kJ

Reaction Progress

C. Acid/Base Neutralization; Exothermic

Energy

Reaction Progress

500kJ

410kJ

200kJ



17. A. Exothermic

B. Reactants

C. The beaker gets warm

D. release energy to the surroundings

E. products have more kinetic energy

F. warmer

G. speed up

H. 500kJ

I. 210kJ released

J. -210kJ

K. 90kJ

L. 300kJ

18. Write the following reactions in ΔH notation.

A.        A + B  →       C + D ΔH = 500 kJ

  B. CuCl2 + MgO → CuO + MgCl2 ΔH = - 36kJ

C. C5H12 + O2 → CO2 + H2O ΔH = - 45 000kJ

D. 2KI + Cl2 → 2 KCl + I2 ΔH = - 423kJ

19. Write the following reaction in Standard Notation.

           A.   H2    +    I2       →        2 HI  + 250kJ

  B. 2NI3   +   3BaCl2  + 175kJ  →    2NCl3    +    3BaI2

  C.2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2+ 229kJ

20. 2AlBr3   +   3BaF2       →    2AlF3    +    3BaBr2 ΔH = -229 MJ

A. the molecules of the products have 229MJ more kinetic energy.

B. the mass of the molecules of the products and reactants are equal.

**Draw the potential energy diagram for reactions 21-22.**

21.

Energy

Reaction Progress

520kJ

450kJ

300kJ



a) decreases   

b) increases      

c) exothermic

d) ΔH= - 150kJ

If a catalyst was added, what would happen to the energies of the:

e) nothing                                                                                      

f) nothing                                                                                         

g) decrease                                                                                   

h) less time

Energy

Reaction Progress

180kJ

140kJ

80kJ

22.

a) How does the potential energy change as the reaction proceeds?

b) How does the kinetic energy change as the reaction proceeds?

c) Is the reaction exothermic or endothermic?

d) What is the value of ΔH?



If the concentration of the reactants was increased,

what would happen to the energies of the:

e) nothing

f) nothing

g) nothing

h) increase

23.  Use the energy diagram below and identify each of the following. Choose from:

*ΔH, Ea (forward, uncatalyzed), Ea (reverse, uncatalyzed), Ea (forward catalyzed),*

*Ea (reverse, catalyzed), Energy of products, Energy of reactants,*

*Energy of activated complex (catalyzed), Energy of activated complex (uncatalyzed)*

Energy

Reaction Progress



a

b

c

d

e

f

g

h

i

**a.** *Energy of activated complex (uncatalyzed)* **b.** *Energy of activated complex (catalyzed)*

**c.** *Energy of products* **d.** *Energy of reactants* **e.** *Ea (forward, uncatalyzed)*

**f.** *Ea (reverse, uncatalyzed)* **g.** *ΔH* **h.** *Ea (forward catalyzed)* **i.** *Ea (reverse, catalyzed)*

**Nuclear Reactions**

24. A nuclear fission reaction is used to generate thermal energy to produce high pressure steam in a nuclear reactor.

A. exothermic

B reactants

C. reactants

25. A nuclear fusion reaction occurs within a star. In this reaction the mass of the reactants is 140.78kg. The mass of the products is 139.92kg.

A. exothermic

B. 7.74x1016J released

C. -7.74x1016J

26. A high energy neutron causes the fission of carbon-11 into hydrogen-2 and boron-10. The reaction absorbs 2.4nJ of energy.

A.

B. endothermic

C. No

D. No, for 2 reasons. Firstly since no neutrons are released the reaction can’t trigger any more nuclei to split. Secondly no endothermic process can run away.

E. 2. x10-26kg is gained.

27. In a nuclear reactor Uranium-235 is induced to fission by a high energy neutron. The fission produces rubidium-96 and Cesium-137 and…

A.

B. 1.8x1014J/s

28. Describe two problems with wind power.

Intermitent power delivery (only makes power when it’s windy)

Requires a lot of space (destroys habitat)

Presents a hazard to birds

Create significant noise pollution

29. Describe two problems with solar power.

Provides low voltage (unsuitable for transport)

Expensive to build solar panels

Materials for solar panels pollute

Solar arrays take up a lot of space.

Only viable in places with a lot of sunlight.