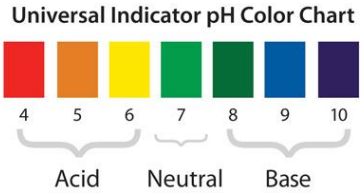
STE Pretest 2.2 (on web site, scroll past questions to see the answers)



1. How many times more acidic is a lemon (pH = 2.30) compared to a honeydew melon(6.60)?

2. If a solution contains 25 ppm of H^+, what is its pH?

3. What is the pH of a substance with 45.0 times more H^+ than a solution at pH = 3.54?

4. What exothermic reaction involving water occurs while somebody is showering?

5. What common endothermic reaction occurs in the kitchen?

6. Olive oil's main fatty acid is oleic acid. When oxidized, it releases energy according to the following?

   $C_{18}H_{34}O_2 + O_2 \rightarrow CO_2 + H_2O + 7050\ kJ$

   How many kJ does oleic acid release for every 1.00 gram of $C_{18}H_{34}O_2$ oxidized? Pay attention to sig figs

7. Which reactant is playing the same role as oxygen does in a fire? Why?

   $2K + Br_2 \rightarrow 2KBr$

8. An average sized banana (118 g) yields 454.300 kJ of heat when burnt to a crisp. If you managed to transfer all of its heat to a pot of water (9 000 g) and the final temperature was 27.4°C,, how warm was the water originally?

   Specific heat of water = 4190 J (kg C) or 4.19 J (g C) (3 marks)

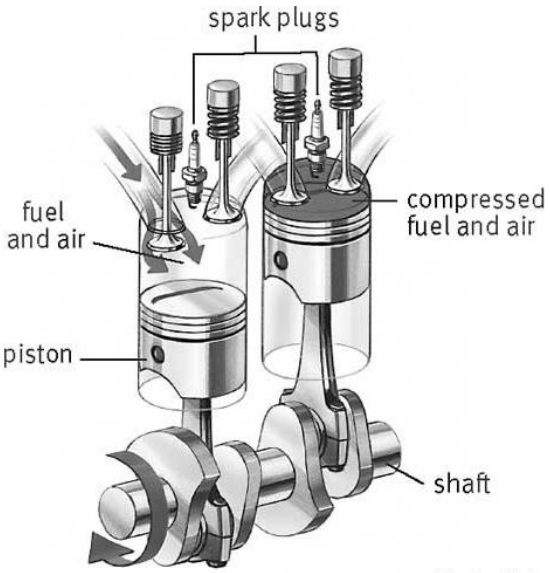
9. **A bathtub filled with water originally at 37.0 °C loses its heat to a well-insulated bath room containing 48 000 L of air, raising the air temperature from 18.0 °C to 26.1 °C. The specific heat of air is 1.0 J/(g °C) and its density is about 1.21 g/L. There is also 370 kg of ceramic and armoires in the bath room which also went from 18.0 °C to 26.1 °C. Their specific heat averages about 0.8 J/(g °C). How much water was in the bathtub?**

ST Pretest

1. What does the pH become if a lake originally at pH = 6 becomes 100 times more acidic due to acid rain?

2. Which is a more concentrated base? One at pH = 10 ? Or one at pH = 11?

3. Give an example of how a room cannot always be heated by an object whose temperature is very high.



4. a) How do gases within an engine do work on the pistons?

   b) What form of energy is contained within gasoline?

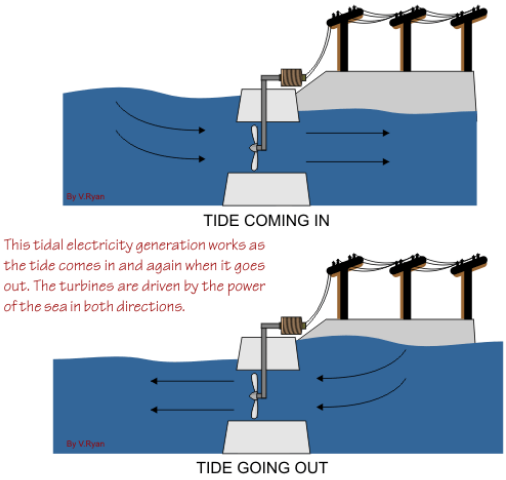
   c) What forms of energy are contained within the hot exhaust?

5. a) Is energy always conserved?

   b) Give three forms of energy that the energy of food turns into once after it's eaten, digested and further broken down by cellular respiration?

6. a) How can tidal energy be used?

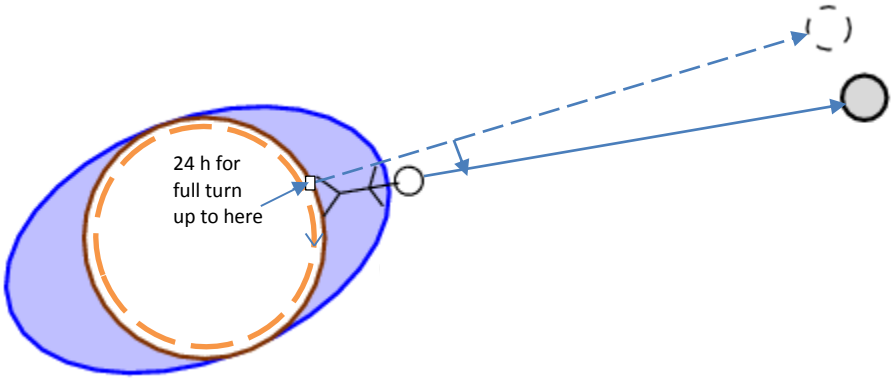
   b) If the movement of water represents 5 billion joules and we obtain 4 billion joules of electricity, how efficient is the tidal power plant? (Express as a %)
   c) What percent of the energy is wasted?



7. a) How often will the tide be coming in during the day?

   b) What two things are responsible for causing tides?

   c) Why is the tidal cycle of 2 low tides and two high tides almost 25 hours long and not 24?



Flashbacks from your happy past

8. Which alkali atom has less than 10 protons?
9. Convert 12 ppm to g/ml.
10. How many electrons are in an ion of chloride?
11. How many dots are there in the dot structure of Xe?
12. What is a chemical characteristic property of alcohol?
13. Write ionic equations for the following electrolytes:

Acids:

a) HBr→

b) HI→

c) HNO_3→

Bases:

d) NaOH→

e) $Mg(OH)_2$→

f) KOH

Salts:

g) NaBr→

h) $Ca(NO_3)_2$→

i) $AlBr_3$→

Answers: STE Pretest 2.2

1. How many times more acidic is a lemon(pH = 2.30) compared to a honeydew melon(6.60)?

$$\frac{high\ conc.}{low\ conc.} = \frac{10^{-2.30}}{10^{-6.60}} =$$ 19 953 times more acidic

2. If a solution contains 25 ppm of H^+, what is its pH?

$$[H^+] = \frac{25\ mg}{L} = \frac{0.025g\ H^+}{L} = \frac{0.025g\ (\frac{mol}{1g})}{L}$$

$$= \frac{0.025\ mol}{L}$$

$$pH = -\log\left(\frac{0.025\ mol}{L}\right) = 1.60$$

3. **What is the pH of a substance with 45.0 times more H^+ than a solution at pH = 3.54?**

At pH = 3.54, the concentration of $H^+ = 10^{-pH} = 10^{-3.54}$ M

For a solution that's 45.0 times more concentrated

pH= -log(45.0* $10^{-3.54}$ M) = 1.89

4. What exothermic reaction involving water occurs while somebody is showering?

Condensation of water vapor on cold bathroom surfaces

5. What common endothermic reaction occurs in the kitchen?

Cooking absorbs heat and chemically changes food.

6. Given: Olive oil's main fatty acid is oleic acid. When oxidized, it releases energy according to the following?

$C_{18}H_{34}O_2 + O_2 \rightarrow CO_2 + H_2O + 7050$ kJ

How many kJ does oleic acid release for every 1.00 gram of $C_{18}H_{34}O_2$ oxidized?

1.00g/ (282g/mole)= 0.0035460992907801418439716312056 7 moles (don't round yet!)

0.0035460992907801418439716312056 7mole * 7050kJ/mole = 25.0 kJ (3 sig figs)

7. Which reactant is playing the same role as oxygen does in a fire? Why?

$2\ K + Br_2 \rightarrow 2\ KBr$

In a fire oxygen "steals" electrons. So here bromine is the oxidizer because each Br atom takes an electron from each atom of K.

8. An average sized banana (118 g) yields 454.300 kJ of heat when burnt to a crisp. If you managed to transfer all of its heat to a pot of water (9 000 g) and the final temperature was 27.4°C,, how warm was the water originally?

Specific heat of water = 4190 J (kg C) or 4.19 J (g C) (3 marks)
$Q = mc\Delta T$
454 300 J = 9000 g(4.19 J/(g °C)(27.4 – x) °C
x = 15.3 °C

9. **A bathtub filled with water originally at 37.0 °C loses its heat to a well-insulated bath room containing 48 000 L of air, raising the air temperature from 18.0 °C to 26.1 °C. The specific heat of air is 1.0 J/(g °C) and its density is about 1.21 g/L. There is also 370 kg of ceramic and armoires in the bath room which also went from 18.0 °C to 26.1 °C. Their specific heat averages about 0.8 J/(g °C). How much water was in the bathtub?**

$-Q_{hot} = Q_{air} + Q_{material}$

-x*4.19 **J/(g °C** *(26.1-37) = 48000 L*1.21g/L ***1.0 J/(g °C)** *(26.1-18) + 370000g*0.8 **J/(g °C)** *(26.1-18)

x = 62 798 g of water or 62.8 L

ST Answers

1. What does the pH become if a lake originally at pH = 6 becomes 100 times more acidic due to acid rain?

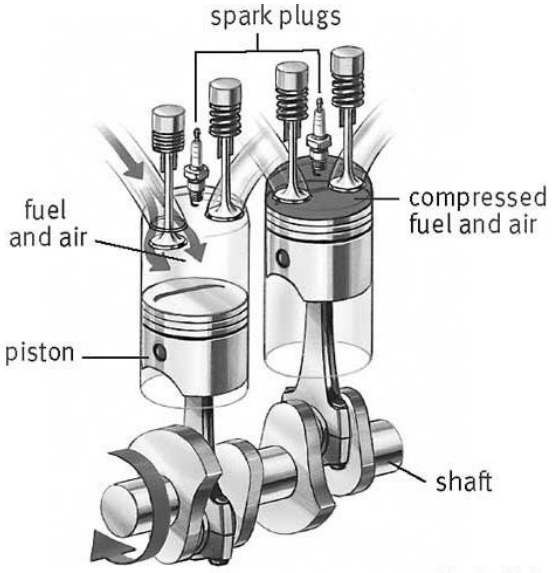
   100 10^2, so we subtract the exponent of 2 from 6 to get an answer of 4.

2. Which is a more concentrated base? One at pH = 10 ? Or one at pH = 11?

   11

3. Give an example of how a room cannot always be heated by an object whose temperature is very high.

   If the object's mass is too small it will not have enough heat to warm up the entire room.



4. a) How do gases within an engine do work on the pistons?

   Their molecules move fast and they push and on the pistons and move them.

   b) What form of energy is contained within gasoline?

   Chemical potential energy

   c) What forms of energy are contained within the hot exhaust?

   Thermal and chemical potential energy

5. a) Is energy always conserved?

   Yes

   b) Give three forms of energy that the energy of food turns into once after it's eaten, digested and further broken down by cellular respiration?

   Mechanical energy (in moving muscles)
   Body heat
   Chemical storage (memories, fat etc)

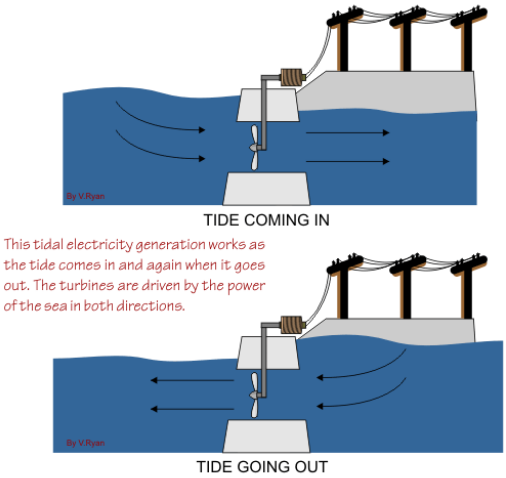
6. a) How can tidal energy be used?

   The moving water from the tide action can turn turbines.

   b) If the movement of water represents 5 billion joules and we obtain 4 billion joules of electricity, how efficient is the tidal power plant? (Express as a %)

   useful/tidal *100% =4/5*100% = 80%

   c) What percent of the energy is wasted?



100%– 80 % = 20%

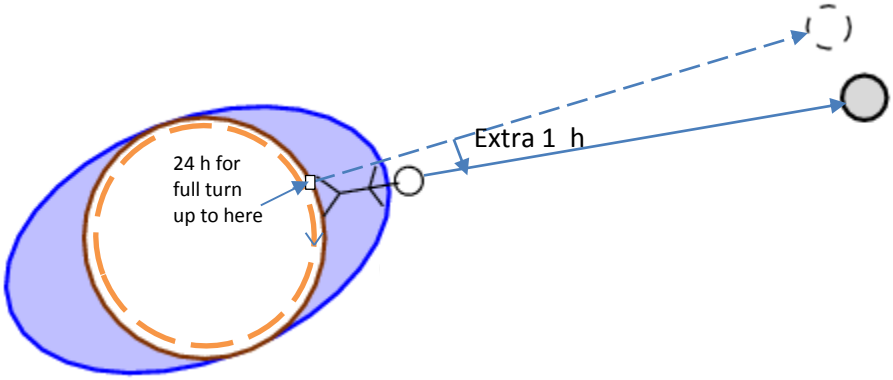
7. a) How often will the tide be coming in during the day?

Almost 2 times a day it will come in(high tide) and almost twice a day it will flow out(low tide).

b) What two things are responsible for causing tides?

Moon's gravitational force and the earth's inertia

c) Why is the tidal cycle of 2 low tides and two high tides almost 25 hours long and not 24?



The moon moves around the earth while the earth rotates on its axis. The broken line shows where high tide would be if the moon had not moved after 24 hours. So after a full day, the biggest part of the tidal bulge is further ahead in time. The solid line is where the moon actually is after 24 hours, so the earth has to rotate a little more to get to that point—about another hour.

Flashbacks from your happy past

8. Which alkali atom has less than 10 protons? Li

9. Convert 12 ppm to g/ml.

12 ppm means 12 mg/L

12 mg (g/1000 mg) = 0.012 g

1 L = 1000 mL

12 mg/L = 0.012g /1000ml = 0.000012 g /ml

10. How many electrons are in an ion of chloride?

Chloride ion = $_{17}Cl^-$:
E = p- c = 17- (-1) = 18

11. How many dots are there in the dot structure of Xe? 8

12. What is a chemical characteristic property of alcohol? It's flammable.

13. Write ionic equations for the following electrolytes:

Acids:

j) $HBr \rightarrow H^+_{(aq)} + Br^-_{(aq)}$

k) $HI \rightarrow H^+_{(aq)} + I^-_{(aq)}$

l) $HNO_3 \rightarrow H^+_{(aq)} + NO_3^-{}_{(aq)}$

Bases:

m) $NaOH \rightarrow Na^+_{(aq)} + OH^-_{(aq)}$

n) $Mg(OH)_2 \rightarrow Mg^{+2}_{(aq)} + 2\ OH^-_{(aq)}$

o) $KOH \rightarrow K^+_{(aq)} + OH^-_{(aq)}$

Salts:

p) $NaBr \rightarrow Na^+_{(aq)} + Br^-_{(aq)}$

q) $Ca(NO_3)_2 \rightarrow Ca^{+2}_{(aq)} + 2\ NO_3^-{}_{(aq)}$

r) $AlBr_3 \rightarrow Al^{+3}_{(aq)} + 3\ Br^-_{(aq)}$