Final Review Name: Key

Unit 6 - Momentum and Impulse

1.) What is the formula for momentum and what do all of the letters mean?

$p = mv$ p - momentum m - mass v - velocity

2.) What is the formula for impulse and what do all of the letters mean?

$J = Ft$ J = impulse F = Force t = time

3.) A 1000 kg car is moving at 20 m/s. The momentum of the car is:

$p = mv$ $p = (1000\text{ kg})(20\text{ m/s}) = \boxed{20000\text{ kgm/s}}$

4.) A ball was hit by a bat. The impact force is 250 N, and the contact time is 0.2 s. What is the impulse received by the ball?

$J = Ft$ $J = (250\text{N})(.2\text{s}) = \boxed{50\text{Ns}}$

5.) A car crashed into a wall. The impulse is 4000 N-s and the impact time is 0.5 s. What is the impact force on the car?

$J = Ft$ $\frac{4000\text{Ns}}{.5} = \frac{F(.5\text{s})}{.5}$ $\boxed{F = 8000\text{ N}}$

6.) The momentum of a car is 35,000 kgm/s. The mass of the car is 1500 kg. What is the velocity of the car?

$p = mv$ $\frac{35{,}000\text{ kgm/s}}{1500\text{ kg}} = \frac{1500\text{kg}(v)}{1500\text{ kg}}$ $\boxed{v = 23.3\text{ m/s}}$

7.) A 1000 kg car crashed into a garden and stopped. The impulse is 4000 Ns and the impact force is 2000 N. How long it takes for the car to stop?

~~$p = mv$~~ $J = Ft$ $\frac{4000\text{Ns}}{2000\text{N}} = \frac{2000\text{N}(t)}{2000\text{N}}$ 2 seconds

8.) A 2 kg model airplane travels with a velocity of 10 m/s north. A tail wind (blowing from behind) applies a force of 1 N to the north for 2 seconds. What is the final velocity of the airplane?

$m = 2\text{kg}$ $t = 2\text{s}$ $Ft = m(v_f - v_i)$ $(1\text{N})(2\text{s}) = (2\text{kg})(v_f - 10\text{m/s})$

$v_i = 10\text{m/s}$ $v_f = ?$ $2\text{Ns} = 2v_f - 20\text{kgm/s}$

$F = 1\text{N}$ $+20 \quad 22 = 2v_f + 20$ 11 m/s

9.) In an inelastic collision, a 900 kg car is at rest at a traffic light when a 760 kg car traveling at 10m/s crashes into its rear. Assuming that no breaks are used, what is the velocity of the cars after the collision?

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$ $900\text{kg}(0\text{m/s}) + (760\text{kg})(10\text{m/s}) = (900\text{kg} + 760\text{kg})v$

$0\text{m/s} + \frac{7600\text{kgm/s}}{16660} = \frac{16660\text{kg}(v)}{16660}$ $\boxed{v = 4.578\text{ m/s}}$

Unit 7- Thermal Energy

10.) Convert 75°C to °F

$T_F = \frac{9}{5}(75°C) + 32 = \boxed{167°F}$

11.) Convert 525°K to Fahrenheit.

$525°K - 273 = 252°C$

$T_F = \frac{9}{5}(252°C) + 32 = \boxed{485.6°F}$

12.) Convert 39°F to °C

$T_C = \frac{5}{9}(T_F - 32)$ $T_C = \frac{5}{9}(39°F - 32) = \boxed{3.89°C}$

13.) 8 kg of a substance with specific heat 357 J/kg°C experiences a change of 2,508 J of heat. If its final temperature is 87°C, what is its initial temperature?

$\Delta Q = mc\Delta T$ $2508\,J = (8kg)(357\,J/kg°C)(87°C - T_i)$

$2508 = 2856(87°C - T_i)$

$2508\,J = 248472°C - 2856T_i$

$-248472 \quad -248472$

$-245964 = -2856T_i$

$\boxed{T_i = 86.12°C}$

14.) 25 kg of water is heated from 20°C to 100°C. What is the change of heat?

$\Delta Q = mc\Delta T$ $\Delta Q = (25kg)(4186)(100 - 20) = \boxed{8,372,000\,J}$

15.) 2 kg of mercury (c = 140 J/kg °C) at 100 °C is combined with 2 kg of water at 50 °C. What is the equilibrium temperature?

Substance	Heat of Fusion (J/kg)	Heat of Vaporization (J/kg)
Helium	5,233	20,900
Hydrogen	58,600	452,000
Nitrogen	25,500	201,000
Oxygen	13,800	213,000
Mercury	11,800	272,000
Water	335,000	2,256,000
Sulfur	38,100	326,000
Lead	24,500	871,000
Silver	88,300	2,336,000
Gold	64,500	1,578,000
Copper	134,000	5,069,000

$mc\Delta T = -mc\Delta T$

$(2kg)(4186)(T_f - 50) = -(2kg)(140)(T_f - 100)$

$8372T_f - 418600 = -280T_f + 28000$

$+280T_f \quad +418600 \quad +280T_f \quad +418600$

$\frac{8652T_f}{8652} = \frac{446600}{8652}$

$\boxed{T_f = 51.6°C}$

16.) Using the chart above, how much heat energy is required to melt an 8 kg block of ice? solid → liquid

$\Delta Q = mh_f$ $\Delta Q = 8kg(335,000J/kg) = \boxed{2,680,000\,J}$

17.) Which of the following is listed in order from least kinetic energy to greatest kinetic energy?

a. Water, Ice, Vapor (b.) Ice, Water, Vapor c. Vapor, Water, Ice

18.) A substance with a high specific heat value will _____.

a. decrease its temperature when combined with another substance

(b.) require more energy to raise its temperature by 1°C

c. have more total kinetic energy

19.) Define conduction, convection and radiation

conduction – direct contact

convection – indirect contact

radiation – no contact

20.) C is the number that indicates how much material will lengthen when heated.

a. initial length b. specific heat c. coefficient of expansion

UNIT 8- WAVES

21.) A wave has a velocity of 7.4 m/s and a frequency of 34 Hz. What is the wavelength of the wave?

$\lambda = \frac{v}{f}$ $\lambda = \frac{7.4\ m/s}{34\ Hz} = .218\ m$

22.) A transverse wave is traveling with a wavelength of .04 m and at a frequency of 12 Hz. What is the speed of the wave?

$v = \lambda f$ $v = (.04m)(12\ Hz) = .48\ m/s$

23.) A wave is traveling at 8 m/s and is .025 m from crest to crest. How many cycles per second is the wave traveling?

$f = \frac{v}{\lambda}$ $f = \frac{8\ m/s}{.025m} = 320\ Hz$

24.) Bananas are placed on a spring scale to weigh them. The mass of the bananas is .37 kg. The spring has a spring constant of 415 N/m. What is the distance that the spring stretched?

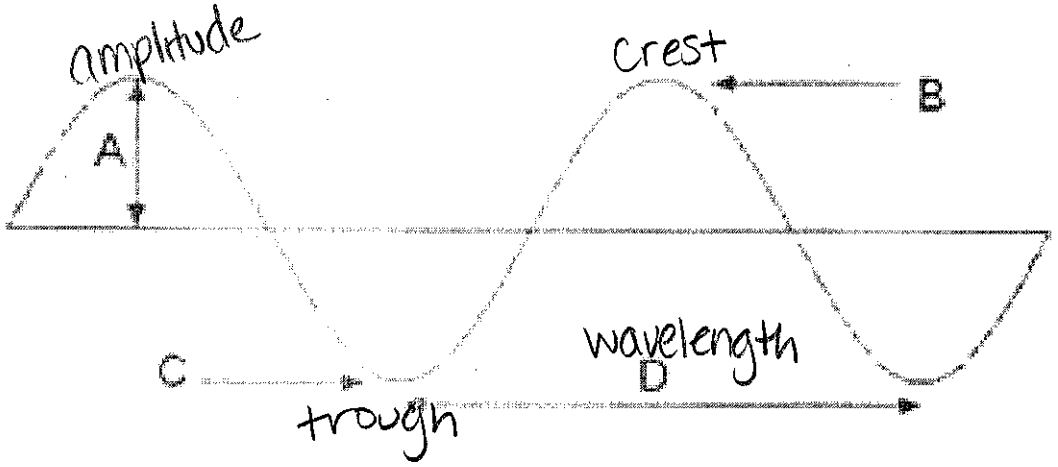
$Fw = mg$ $Fw = (.37\ kg)(9.8\ m/s^2)$ $Fw = 3.626\ N$

$F = kx$ $\frac{3.626N}{415} = \frac{415\ N/m\,(x)}{415}$ $x = 0.0087m$

25.) An ambulance is coming closer to the observer. If the ambulance is going 34 m/s and the frequency of the siren is 450 Hz, what is the frequency that is observed by the person? (Speed of sound is 340 m/s)

$f_o = \frac{v}{v - v_s}(f_s)$ $f_o = \left(\frac{340\ m/s}{(340\ m/s - 34\ m/s)}\right)(450\ Hz) = 500\ Hz$

26.) Label the wave



27.) How are frequency and period related in simple harmonic motion?

a. They both measure the time per cycle
b. They are directly proportional
(c.) They are inversely proportional

28.) In the waveform of a longitudinal wave

a. the vibrational displacement occurs in a direction perpendicular to the motion of the wave
(b.) the vibrational displacement occurs in a direction parallel to the motion of the wave
c. neither A or B are correct

29.) How many nodes does a 207th harmonic standing wave have?

a. 206 nodes b. 207 nodes (c.) 208 nodes

30.) (T) or F: Hooke's Law states that the force exerted by a spring is directly proportional to the amount it is stretched.

31.) T or (F) The unit for period is Hertz, or cycles per second.

UNIT 9- Light and Optics

32.) Fill in the chart:

King	Henry	Died	by	drinking	chocolate	milk
Kilo	Hecto	Deka	base unit	deci	centi	milli

33.) Convert 4 km to millimeters KHDbdcm

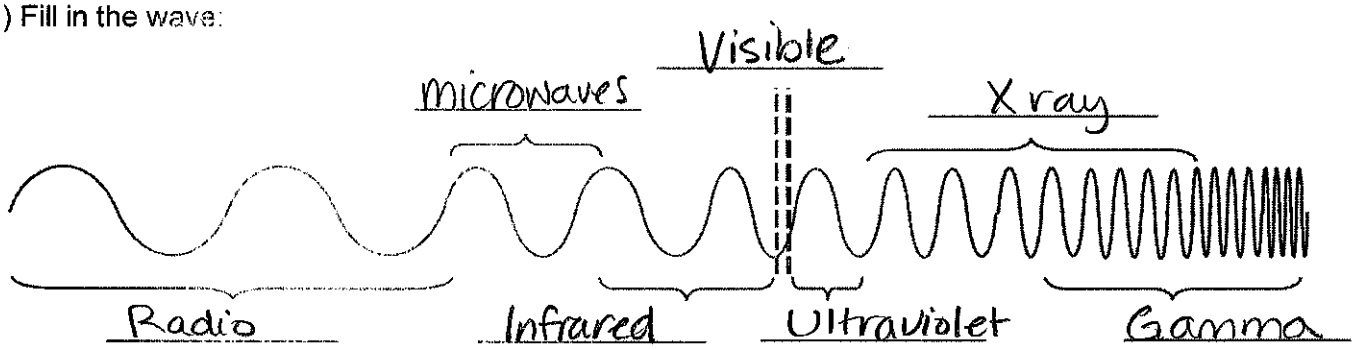
4.000000 4,000,000 mm

34.) Convert 3.8 gigahertz to nanohertz. Put your answer in scientific notation.

G--M--KHDbdcm--μ--n

3.800000000000000000 3.8×10^{18} nHz

35.) Fill in the wave:



36.) An electromagnetic wave has a wavelength of 2,000 nm. What is the frequency of this wave?

$f = \frac{c}{\lambda}$ 0.000002000 $\frac{3.0 \times 10^8 \text{ m/s}}{.000002 \text{ m}} =$

37.) The primary colors are red, blue and green

38.) The secondary colors are magenta, cyan, and yellow

39.) Find the angle of refraction for a ray of light that enters a bucket of water from air at an angle of 25° to the normal. Index of refraction of air = 1, Index of refraction of water = 1.333

$n_i \sin\theta_i = n_r \sin\theta_r$

$1 \sin 25° = 1.333 \sin\theta_r$

$\frac{.4226}{1.333} = \frac{1.333 \sin\theta_r}{1.333}$

$.317 = \sin\theta_r$ $\sin^{-1}(.317) = \theta_r$

$\theta_r = 18.5°$

40.) Which color is produced by mixing green light and blue light?

White light b. yellow light (c) cyan light d. magenta light

41.) Which of the following from the electromagnetic spectrum has the longest wavelength?

(a) Radio b. red light c. Gamma d. x- ray

42.) An object located 30 cm in front of a lens forms an image on a screen 10 cm behind the lens. What is the focal length of the lens?

$\frac{1}{f} = \frac{1}{di} + \frac{1}{do}$ $\frac{1}{f} = \frac{1}{10cm} + \frac{1}{30cm} =$ **f = 7.5 cm**

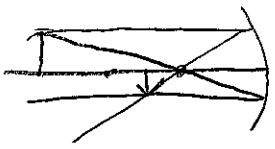
43.) Find the height of an image when a 6 cm tall object placed 48 cm from a concave mirror that has a focal length of 18 cm. (Put answer in centimeters and meters).

$\frac{1}{f} = \frac{1}{di} + \frac{1}{do}$ $\frac{1}{18} = \frac{1}{di} + \frac{1}{48}$ $.0556 = \frac{1}{di} + .0208$ $-.0208 \quad -.0208$ $\frac{1}{di} = .0348$ **di = 28.7 cm**

$\frac{hi}{ho} = \frac{-di}{do}$ $\frac{hi}{6} =$ -

44.) ***For each problem draw a ray diagram and solve for the appropriate variables using the formulas provided.***

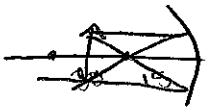
1. Determine the image distance and image height for a 5.0 cm tall object placed 45 cm from a concave mirror having a focal length of 15cm.



$\frac{1}{f} = \frac{1}{di} + \frac{1}{do}$ $\frac{1}{15} = \frac{1}{di} + \frac{1}{45}$ $0.067 = \frac{1}{di} + 0.022$ **di = 22.2 cm**

$\frac{hi}{ho} = \frac{-di}{do}$ $\frac{hi}{5} = -\frac{22.2}{45}$ **hi = -2.5 cm**

2.) Determine the image distance and image height for a 5 cm tall object placed 20 cm from a concave mirror having a focal length of 15 cm.



$\frac{1}{f} = \frac{1}{di} + \frac{1}{do}$ $\frac{1}{15} = \frac{1}{di} + \frac{1}{20}$ $.0667 = \frac{1}{di} + 0.05$ **di = 58.8 cm**

$\frac{hi}{ho} = \frac{-di}{do}$ $\frac{hi}{5} = \frac{-58.8}{\quad}$

45.) Be able to recognize what kind of images are produced from concave and convex mirrors as well as concave and convex lens.

UNIT 10 – Electricity

46.) Define electrostatics

the study of electric charges, forces & fields

47.) Formula for Coulomb's law:

$$F = \frac{Kq_1 q_2}{d^2}$$

48.) Formula for Ohm's Law.

$$V = IR$$

49.) A negative charge of -2.0×10^{-4} C and a positive charge of 8.0×10^{-4} C are separated by 0.30 m. What is the force between the 2 charges?

$$F = \frac{(9.0 \times 10^9)(-2.0 \times 10^{-4} C)(8.0 \times 10^{-4} C)}{(0.30 m)^2} = -16000 N$$

50.) A walkman uses a standard 1.5 V battery. How much resistance is in the circuit if it uses a current of 0.01 A?

$$V = IR \qquad \frac{1.5 V}{0.01} = \frac{0.01(R)}{0.01} = 150 \Omega$$

51.) A light bulb has a resistance of 17 ohms and a maximum current of 30 A. How much voltage can be applied before the bulb will break?

$$V = IR \qquad V = (30A)(17 \Omega) \qquad V = 510 V$$

52.) What is the difference between a series circuit and a parallel circuit?

A series circuit has only one path to travel.

A parallel circuit has multiple paths to travel.

53.) In a series circuit, a 12.0 V battery is connected to three resistors: 6 Ω. 15 Ω, and 21 Ω. What is the total resistance?

$$R_T = R_1 + R_2 + R_3$$

$$R_T = 6 \Omega + 15 \Omega + 21 \Omega = 42 \Omega$$

54.) In a parallel circuit, a 9 V battery is connected to three resistors: 10Ω, 24Ω and 28Ω. What is the total resistance?

$$\frac{1}{R_T} = \frac{1}{10 \Omega} + \frac{1}{24 \Omega} + \frac{1}{28 \Omega} = 5.6 \Omega$$

55.) What current flows through a hair dryer plugged into a 120 Volt circuit if it has a resistance of 20 ohms?

$$V = IR$$

$$\frac{120 V}{20} = \frac{I(20 \Omega)}{20} \qquad I = 6 A$$