SPH3U REVIEW

CH 1 – Motion

Define: Scalar, Vector, Uniform Motion, Non-Uniform Motion, Distance, Displacement, Speed, Velocity, Acceleration.

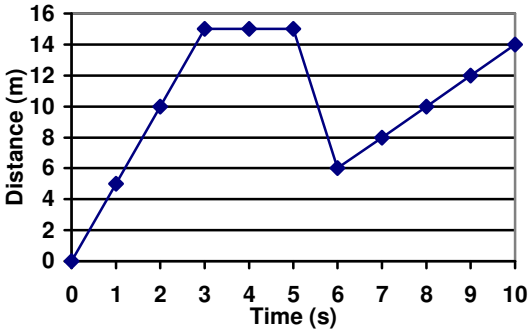
Problems: **Know how to solve similar questions to the following:**

1. A jogger runs 6 km [N] then 12 km [S] during a 2 h race. Determine the runner's:
   a. Average speed
   b. Average velocity

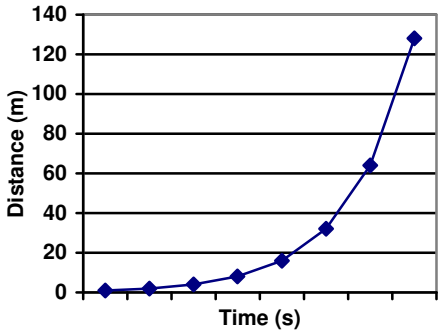
2. Bill travels at a speed of 30 m/s for 1 h. How far did Bill go?

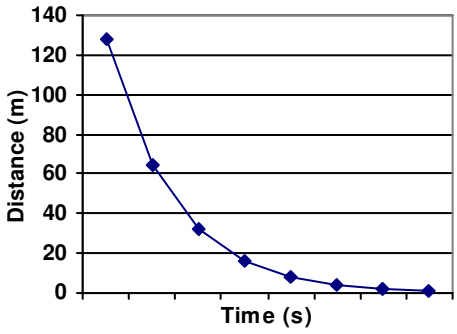
3. How long would it take for the space shuttle to go 8.3×10^6 km at an average speed of 1.2×10^3 km/h?

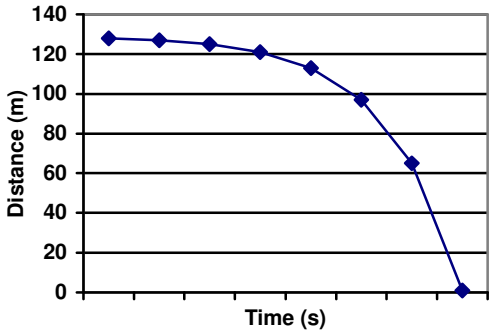
4. Calculate the speed of each section of the following distance-time graph:



5. Describe the magnitude and direction for each of the following:



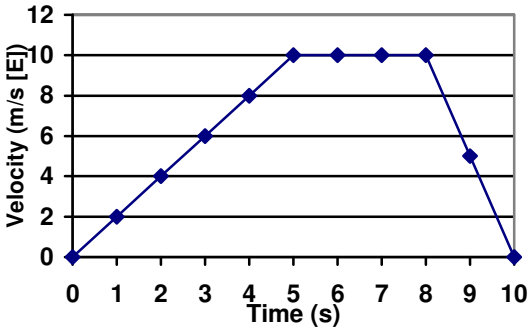




6. A car speeds up from 20 km/h to 100 km/h in 11 seconds. Calculate the acceleration.

7. A golf ball is bounced off the ground and travels straight up at an initial velocity of 32 m/s.
   a. When will the ball reach its max height?
   b. How far off the ground is the ball at its max height?
   c. If you are 2 m tall and wish to catch the ball, how long will you have to wait after the bounce?

8. Calculate the accelerations of each section and the displacement traveled using the following velocity-time graph:



CH 2 – Relative Velocity

Define: Know how to draw diagrams, read directions, and use trig

Problems: **Know how to solve similar questions to the following:**

1. A car travels 15 km [S 25° E] and then travels 6.3 km [N]. Find its displacement.

2. A boat sails 125 km [N 40° W] and then 150 km [W]. Find its displacement.

3. A plane has an air speed of 200 km/h [N], there is a wind altering the path of the airplane as it blows 75 km/h [N 30° E]. What is the planes velocity relative to the ground and what is its heading?

4. A swimmer who can swim at 5 m/s relative to the water wishes to travel due south across a river. The current in the river is 3 m/s [E].

a. What heading must the swimmer take to make it directly across the river?

b. If the river is 200 m across, how long will it take the swimmer to span the distance?

5. On their way to the World Baseball Championships, the Nobles baseball team is warming up on the plane with a little batting practice. The plane is traveling 250 km/h [E] relative to the ground. The pitcher is at the front of the plane and the batter is at the back of the plane. The pitcher throws the baseball at a speed of 100 km/h. The batter swings the bat at 75 km/h. The batter then hits the ball making it travel 175 km/h.

a. What is the velocity of the ball relative to the ground when the pitcher throws it?

b. What is the velocity of the ball relative to the bat?

c. What is the velocity of the ball relative to the ground after the batter hits it?

CH 3 - Forces

Definitions: Static friction, kinetic friction, coefficient of friction, Newton, force of gravity, free-body diagram, mass, weight, force, kinds of forces, Newton's 3 laws, balanced force, unbalanced force.

Problems: **Know how to solve similar questions to the following:**

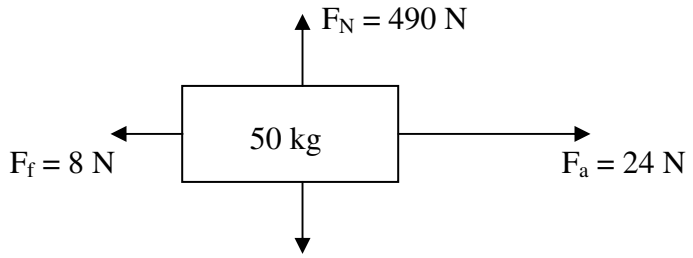
1) **1.** An applied horizontal force of 50N is needed to overcome friction to pull a 30 kg bobsled at constant speed over the snow to the finish line.

a) Draw a free body diagram showing all the forces acted on the bobsled

b) Calculate the coefficient of friction between the bobsled and the snow.

2) Tell a story of a situation that involves all three of Newton's Laws.

3) Describe and calculate what is happening to the object in the following free-body diagram:



4) A plane has engines that thrust forward at 2000 N. It also has wings that create lift at 1000N. What is the resultant of these forces? Which direction would friction or drag be?

5) Describe a situation where normal force and gravitational force are different.

6) **a)** A bowling ball is accelerated at 6m/s^2 by a force of 30.0N. Calculate the ball's mass

b) Calculate the applied force needed to accelerate a 7.5 kg mass at 3 m/s^2 against a 5.5 N force of friction.

7) John's mother asked him to dispose of an old 150 kg couch. Tim disposes of the couch at rest by flinging it over a steep cliff at a landfill site that is 500 m deep. A 20 N force of air resistance acts on it as it is dropped.

a) Calculate the force of gravity acting on the couch.

b) What is the unbalanced force acting on the couch as it is falling? Provide a free body diagram.

c) Calculate the acceleration of the couch.

d) How far will the couch fall in 4 seconds?

e) How long will it take for the couch to hit the bottom?

CH 4 – WORK, POWER, ENERGY

Definitions: Law of conservation of energy, Gravitational Potential Energy, Kinetic energy, Thermal energy, Types of Energy, Work, Power, Energy.

Problems: **Know how to solve similar questions to the following:**

1. A force of 75 N is used to pull a sled 17.4 m across the snow. Calculate the work done.

2. If the same sled was pulled the same distance but we account for a 10 N force of friction, how much work is done (*Trick Question).*

3. If the same sled was pulled the same distance but across gravel and an ***additional*** 50 N of force is required to overcome friction, how much work is done?

4. How is it possible to achieve ZERO WORK?

5. Determine the power it takes to pull the sled across the gravel in question 3 if it takes 5.6 s.

6. How much work can be done by a 700 W hair dryer in 1 hour?

7. A car's engine exerts a force of 25000 N to move the car 1 km. How much work is done in this case? Where did the car get this energy? What is the energy converted to?

8. Your body burns approximately 8 400 000 J of energy a day. How much power is that? Where does that energy go?

9. Convert 1 KW-h to Joules

10. List 8 types of energy.

11. What is the total energy of an object that is 25m above the ground moving at 2m/s?

12. A sled is on top of a 10m tall hill. How fast will the sled be going at the bottom of the 50m long hill if the force of friction is 150 N?

13. A 75 kg roller skating daredevil step onto a roller coaster track and goes for a ride. He finds himself at the top of the first hill about to start his stunt.

    a. If the hill is 100 m tall, how fast will the daredevil be traveling at the bottom of the hill (assume h = 0 m)

    b. By the way, the daredevil is Keanu Reeves and unfortunately for him, the track isn't finished. Needless to say, Keanu wishes to jump the gap. The ramp inclines from the ground after the first hill and the track ends 20 m above the ground.

        i. How fast will Keanu be going when he leaves the ramp?

        ii. Keanu then flies though the air and hits a safety net 5 m above the ground. With what ***"speed"*** does he hit the net?

CH 5 – Vibrations and Sound

Definitions: Types and characteristics of vibrations, amplitude, wavelength, frequency, period, principle of superposition, constructive interference, destructive interference, super crest, super trough, node, mechanical resonance, acoustic resonance, resonant lengths, open column, closed column, volume, pitch, quality.

Problems: **Know how to solve similar questions to the following:**

1. **Complete:** (short answers)
   - **(a)** Normal Human Frequency Range (h.f.r.) is from _____ to _____
   - **(b)** Sounds above h.f.r. are called _____
   - **(c)** Sounds below h.f.r. are called _____
   - **(d)** Another word that means amplitude of sound is _____
   - **(e)** Pushing a child on a swing is a specific example of _____ _____
   - **(f)** 0 decibels is _____
   - **(g)** 160 decibels is _____
   - **(h)** How many times louder is 70 dB than 20 dB? _____
   - **(i)** What will be heard if tuning forks of frequencies 345 Hz and 351 Hz are sounded together? _____
   - **(j)** Give one example of acoustic resonance _____
   - **(k)** A guitar and a clarinet are both making a 440 Hz sound at a 90 dB level. How do these two sounds differ on an oscilloscope screen? _____
   - **(l)** Why can't sounds be heard in outer space? _____

2. An FM radio station operates at a frequency of 88.7 MHz. If the radio waves travel at 300 000 000 m/s, find their wavelength. ($M = 10^6$)

3. Calculate the speed of sound in still air at sea level at a temperature of:
   a. 25°C b. -14°C

4. The first resonance length for an air column closed at one end is 12.5 cm when resonated with a certain tuning fork. Find the frequency of the tuning fork if the speed of sound is 337 m/s.

5. Some physics students head outside on a warm day when the temperature is 24°C. Two students stay behind to bang on a metal post while the others walk a distance of 400 m. The students turn to watch Mlex Aendonca and Wrad Bilson take a hammer to the post. If light travels at 300 000 000 m/s, how long will students see the hammer strike before they hear it?

6. The fourth resonant length of a 80 cm long sting vibrates with a frequency of 120 hz. What is the speed of the wave?

7. The second resonance length for an air column open at both ends is 18.5 cm when resonated with a certain tuning fork. Find the frequency of the tuning fork if the speed of sound is 345 m/s.

8. A tuning fork, with the number 1024 Hz written on the side of it, will produce a sound wave that travels away from it at a speed of 345 m/s. As a famous pipe organ maker, you want to make a series of pipes to build your majestic music player. How long will you have to cut the pipe so that it will make sound at the:

   a. 1^{st} Resonance Length of 1024 Hz?

   b. 5^{th} Resonance Length of 1024 Hz?

CH 7 – Electricity

Definitions - Current, amp, charge, coulomb, voltage, volts, resistance, ohms, power, watts, energy, joules, series, parallel, sources of electricity.

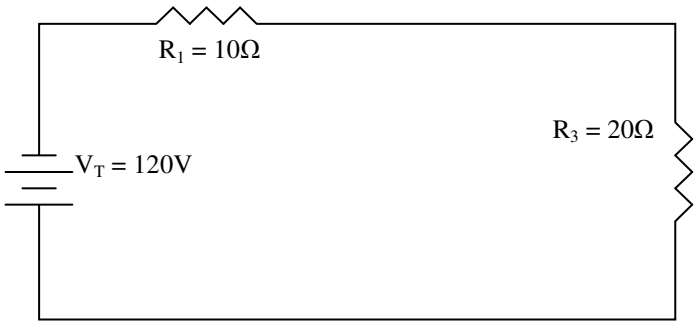
Problems: **Know how to solve similar questions to the following:**

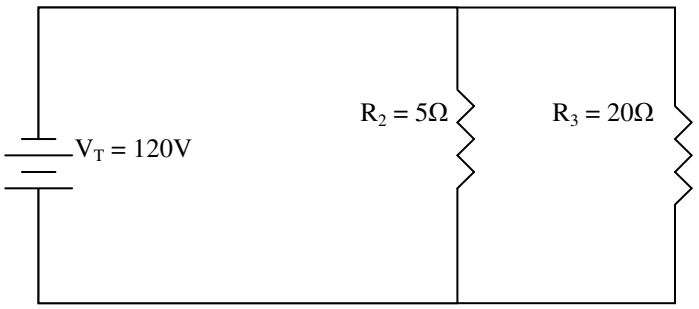
1. Calculate the total resistance of the following resistor combinations:
   25Ω, 30Ω, and 60Ω; if they are connected in:
   a. Series b. Parallel

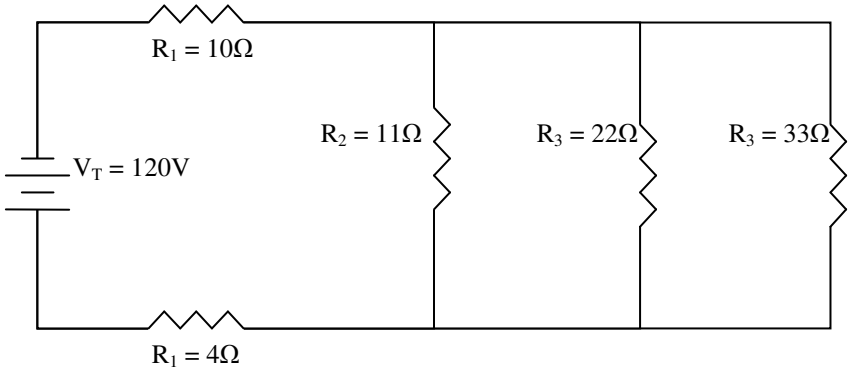
2. Complete the following chart:

Charge (Q)	Current (I)	Time (t)	Voltage (V)	Energy (E)	Resistance (R)	Power (P)
2000 C		20 s				10 000 W
		1.5 min	25 V	500 J		

3. Solve the following circuits:







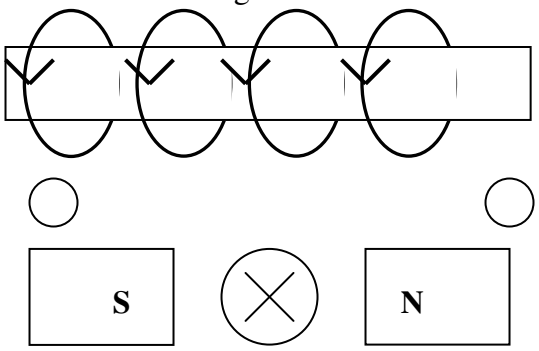
CH 8 – Electromagnetism

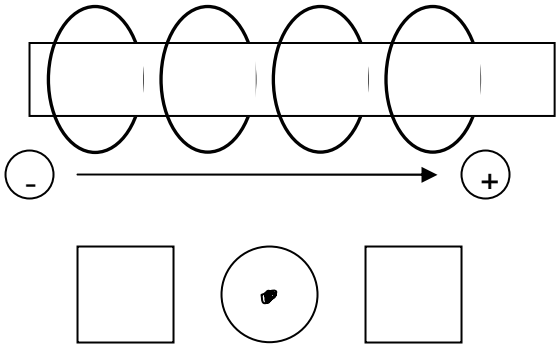
Definitions: Properties of magnetic field lines, factors affecting magnetic induction, transformers (step-up v. step-down), dipole theory, electric motors, left-hand rules.

Problems: **Know how to solve similar questions to the following:**

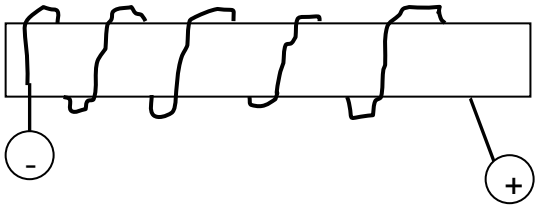
1. Complete the following diagrams:

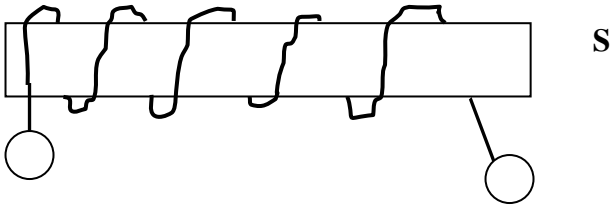
a. Straight line conductors:

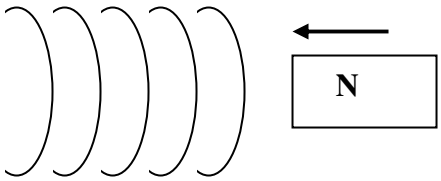


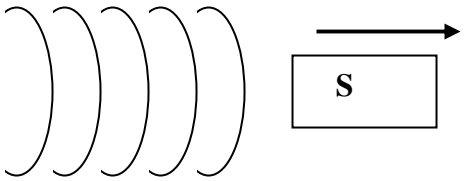


b. Coiled conductors:









2. A transformer has 10 turns on its primary coil and 350 turns on its secondary coil. It is designed to supply a compressor motor requiring a current of 1.5 A at a voltage of 750 V.

a) What is the current in the primary coil?

b) What is the voltage in the primary coil?

3. A hydrogen vapour lamp operates at 1300 V and has a resistance of 40 Ω. A transformer supplies the energy required, from a 120 V power line.

a) Calculate the power used by the transformer

b) Calculate the primary current