KEY

7.) For the figure above (previous page), what force would prevent the mass from moving? $\vec{F}_f$

What minimum value would it need to have? 56N Up ramp

8.) Use your answer from question #7 to calculate the lowest coefficient of friction necessary to hold the object in place. $\mu = 0.697$

9.) A 15.0 kg mass is hung from a cable. What force (magnitude and direction) is acting to pull the mass down? $\vec{F}_g = -147\ N$

10.) Name the force that is holding the mass up in question #9, and calculate its vector. $\vec{F}_e$ $+147N$

11.) If the above cable is stretched 1.5 cm when the mass is hung on it, what is the spring constant of the cable? $K = 98\ \frac{N}{cm}$

12.) On mars, several masses were hung on spring scales, and the following data collected.

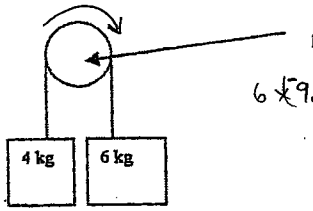
Mass (kg)	Force (N)	Mass (kg)	Force (N)
0.500	2.2	0.750	3.4
1.000	4.6	1.800	8.0
2.000	9.0	2.250	10.3
2.500	11.1	3.000	13.2

Determine the gravitational acceleration of mars. ← line of best fit, slope = 4.4

13.) An elevator with mass 350 kg is accelerating upwards at 1.0 $\frac{m}{s^2}$, what force must be exerted by a cable to pull the elevator up at this rate? $\vec{F}_e = +3780\ N$

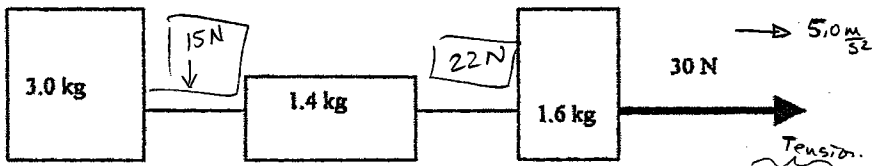
14.) A horse pulls a plow with a 1200 N force to the right. The plow has a mass of 25 kg and is moving at a constant velocity. What is the coefficient of friction in this case? $\mu = 4.89$

15.) Calculate the acceleration of the system below:



$6(-9.81) - 4(-9.81) = -19.62\ N$, $\frac{-19.62\ N}{10Kg} = -1.96\ \frac{m}{s^2}$

16.) The three boxes drawn below are pulled to the right by a 30 N force. If there is no friction, then calculate the force of tension between each box.



(1.) $\vec{F} = m\vec{a}$ / $+30 = 6(\vec{a})$ / $\vec{a} = +5.0\ \frac{m}{s^2}$

(3.) $\vec{F} = m\vec{a}$ / $\vec{F} = (3.0)(+5.0)$ / $\vec{F} = +15N$

(2.) T ← | → 30N

$\vec{F} = m\vec{a}$ / $30 - T = (1.6)(+5.0)$

$T = +22N$

Projectiles, Momentum, and Impulse Review

1.) How many parts are there to every projectile problem, and what are they? Two → Vertical, horizontal

2.) A water balloon is thrown off a 25.0 m high building with a horizontal velocity of $+5.0\ \frac{m}{s}$. How Far from the base of the building will the balloon hit? 11.3 m

3.) A bomber is carpet bombing a city. If the plane is at an altitude of 12 000 m, and flying at 100 $\frac{m}{s}$, how far before reaching the city should the bombs be released? 4950 m

4.) A diver jumps from the 15 m platform. If the edge of the pool extends 3.0 m from the base of the platform, with what initial velocity must the diver jump in order to clear it? $+1.71\ \frac{m}{s}$

5.) A golfer strikes the ball with a speed of 15 $\frac{m}{s}$ at an angle of 40° *to the horizon*, how far will the Ball travel, and what will be its maximum height? 22.5 m, +4.7m

6.) What is the momentum of a 500 kg elephant charging at 25 $\frac{m}{s}$? $+12500\ Kg \cdot \frac{m}{s}$

7.) What is the impulse applied to a ball that hits a wall at 5.0 $\frac{m}{s}$ and rebounds at 5.0 $\frac{m}{s}$? (50 grams) $\Delta\vec{p} = -0.5Kg\frac{m}{s}$

8.) What force was required if the change above occurred in 0.10 s and the ball has mass of 50. g? −50N

9.) A ball of mass 3.0 kg strikes a ball of similar mass. If the second one moves away at 5.0 $\frac{m}{s}$, what was its gain in momentum? $+15\ Kg \cdot \frac{m}{s}$ What was the loss of momentum of the second ball? $-15\ Kg \cdot \frac{m}{s}$

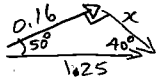
10.) State the law of conservation of momentum? Total momentum of system never changes.

11.) A 15 kg mass travelling at $+5.0\ \frac{m}{s}$ strikes a 20. kg mass at rest. If the 15 kg mass is moving at $+2.0\ \frac{m}{s}$ after the collision, what is the velocity of the other mass? $\vec{v} = +2.25\ \frac{m}{s}$

12.) A mass of 10. kg is moving at $\vec{v}$, it strikes an equal mass and is seen moving away at $+0.4\vec{v}$. What is the velocity of the second mass? $10\vec{v} + 0 = 10\times0.4\vec{v} + 10?$ $10\vec{v} = 4\vec{v} + 10?$ / $6\vec{v} = 10?$ $? = 0.6\vec{v}$

13.) A mass of 10. kg is moving at $+\vec{v}$, it strikes a mass of 4.0 kg and the 4.0 kg mass moves away at $+0.6\vec{v}$. What is the velocity of the 10. kg mass? $0.76\vec{v}$

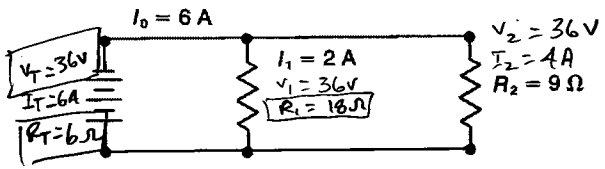
14.) A ball of mass 0.250 kg is moving at 5.0 $\frac{m}{s}$ directly toward a second ball of similar mass at rest. After the collision the first ball can be seen moving away at 0.63 $\frac{m}{s}$ at 50.° to its original path. What is the magnitude of direction of the velocity of the second ball after impact?



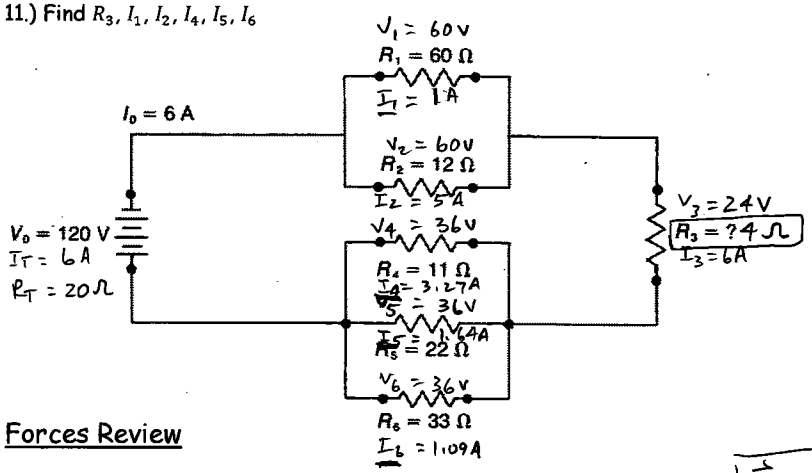
→ 3.83 $\frac{m}{s}$ at 40° to original

KEY

10.) Find V_T, R_1, R_T



11.) Find R_3, I_1, I_2, I_4, I_5, I_6



Forces Review

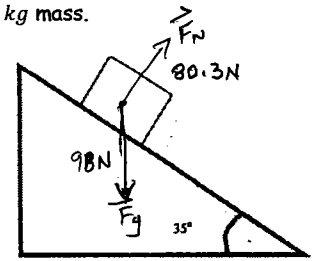
1.) Calculate the force of gravity on a 5.0 kg mass at the earth's surface. $\vec{F}_g = 49N$

2.) Calculate the force of gravity on a 5.0 kg mass 10.0 km above the earth's surface. $\vec{F}_g = 48.8N$

3.) Calculate the spring constant of a spring which is stretched from 3.0 cm to 5.0 cm by a +12 N force. $K = 6.0\frac{N}{cm}$

4.) A car moves from rest to 200 m in 2.5 s. What was the net force exerted by the car if its mass was 1500 kg. $\vec{F}_{net} = 9.6 \times 10^4\ N$

5.) Sketch the diagram below, showing the force of gravity, and normal force on the 10.0 kg mass.



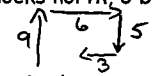
6.) In the figure above, calculate the magnitude of $\vec{F}_g$ and $\vec{F}_n$, what will be the result of these two forces? 56 N Down ramp

Vector Review

(# value, compass bearing)

1.) Define magnitude and direction.

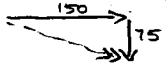
2.) A car moves 9 blocks north, 6 blocks east, 5 blocks south, and 3 blocks west. Draw a diagram to represent this.



3.) What is the car's displacement in #2? 5 block at 37° E of N

4.) What distance did the car travel? 23 blocks

5.) A plane flies due east at 150$\frac{km}{h}$, it encounters a wind blowing south at 75$\frac{km}{h}$. What is the resultant ground speed of the aircraft?



168 $\frac{km}{h}$ at 26.6° S OF E

6.) A boat steers across a river at 15$\frac{m}{s}$, the current flows at 5.0$\frac{m}{s}$. What is the resultant velocity? 15.8 $\frac{m}{s}$ at 18.9° down stream of straight across

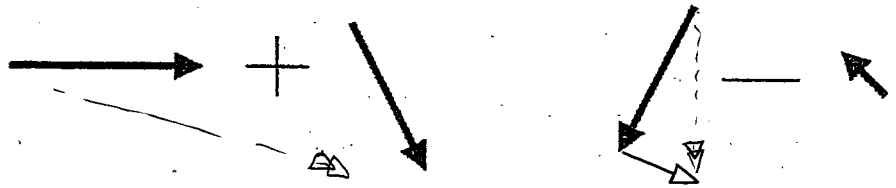
7.) How long does it take to cross the river if the river in #6 is 40.0 m wide? 2.7 s

8.) How far down stream does the boat end up in #7? 13.3 m

9.) A boat wants to get directly across a stream, the engine is capable of attaining a speed of 13.0$\frac{m}{s}$, if the current is 5.0$\frac{m}{s}$, at what heading (angle) should the boat travel, and what would its speed be as viewed from shore? 12 $\frac{m}{s}$ at 22.6° against flow from straight across.

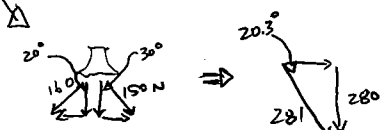
10.) An airplane flies at 200$\frac{m}{s}$ at 45° E of N, a wind blows at 75$\frac{m}{s}$ at 30° W of N. What is the resultant velocity of the aircraft as seen from the ground? 230 $\frac{m}{s}$ at 27° E of N

11.) Sketch the answer to the following diagrams:



12.) Two boys pull on ropes, tied to a stump, by the following forces, 150 N at 30° E of S, 160 N at 20° W of S. Sketch vectors to represent this and calculate the net force acting on the stump.

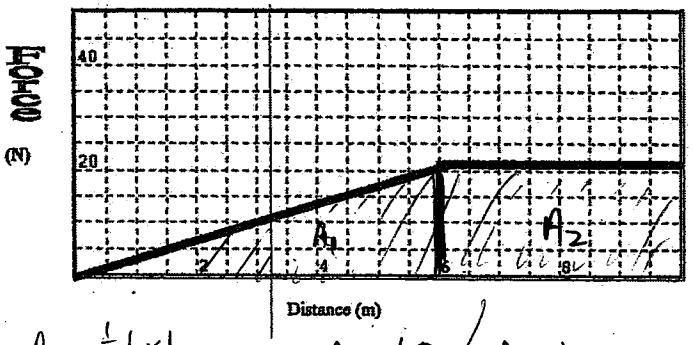
13.) If the stump, in the above question, does not move, what is the minimum force of friction (magnitude and direction) in this situation? 281 N at 85.9° N OF W



ANSWER at 85.9° S OF E

KEY

9.) What was the work done in the graph below? $W = Fxd$ = area under graph.



$W = A_1 + A_2$

$W = 60 + 80$

$W = 140J$

$A_1 = \frac{1}{2}bxh$ $\quad A_1 = 60$ $\quad A_2 = lxw$ $\quad A_2 = 80$

$A_1 = (0.5)(6)(20)$ $\quad A_2 = 4 \times 20$

10.) On a graph of F_f vs. F_n, what physical quantity does the slope represent. μ or Coefficient of friction.

What are the units? ← NO UNITS

Work, Power, Energy, and Circuits Review

1.) What is the work done when pulling a mass with a force of $+25\ N$ a distance of $10.m$. 250 J

2.) Calculate the work done when pushing a shovel of snow $3.0\ m$, if the shovel is held at an angle of $30.°$ to the ground, and a force of $+120\ N$ is applied along the handle. 312J

3.) How much work is done if a $15\ kg$ object is lifted $2.0\ m$ off the ground? 294 J

4.) What is the power used by a student whose mass is $75\ kg$ and runs up $3.0\ m$ in $4.2\ s$? 525W

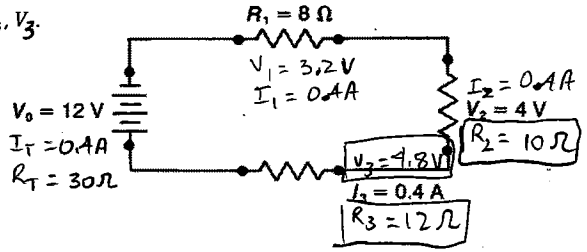
5.) How long does it take a $100\ W$ bulb to consule $75\ J$ of energy? 0.75s

6.) A light bulb with a current of $0.80\ A$ is left burning for $20.min$. How much electric charge passes through the bulb? 960 C

7.) A small motor draws a current of $0.40\ A$. How long will it take for $8.0\ C$ of charge to pass through it? 20 s

8.) A refrigerator compressor draws $2.5\ A$ from a $120\ V$ source, and operates for an average of $15\ min$ out of each hour. Calculate the annual cost of operating the refrigerator if the average cost of electricity is $7.8¢\ kW \cdot h$. $51.28

9.) Find R_2, R_3, V_3.



Kinematics Review

1.) The average velocity of a mini-bike is $+15.0\ \frac{km}{h}$, how long will it take to go $35.0\ m$? 8.4s

2.) A sprinter starting from rest, reaches a final velocity of $+28.0\ \frac{km}{h}$. What is her average velocity? ← +14.4 $\frac{m}{s}$

3.) A coin is dropped and strikes the earth with a velocity of $-15.15\ \frac{m}{s}$. For how long was it falling, and from what height did it fall from? 1.55 s / 11.7 m

4.) A rocket lifts off from the earth at $+13.3\ \frac{m}{s^2}$ from the launch pad, how high into the atmosphere does it rise during the first five seconds of its path? 166 m

5.) A truck accelerates from rest to a velocity of $+22.4\ \frac{m}{s}$ at a rate of $+0.60\ \frac{m}{s^2}$. How long was it accelerating for, and how far did it travel while accelerating? 37.3 s / 418 m

6.) A car in a school zone accelerates from $85\ \frac{km}{h}$ to $120.\ \frac{km}{h}$ in $9.2\ s$. What was its acceleration? +1.0 $\frac{m}{s^2}$

7.) How long will it take for a rock to fall to the ground if dropped from a height of $92.0\ m$? 4.3s

8.) A rock is thrown down from a rail trestle with height $13.0\ m$ at a velocity $+18.8\ \frac{m}{s}$. With what velocity will it strike the ground? -24.7 $\frac{m}{s}$

9.) A car travelling at $60.\ \frac{km}{h}$ accelerates at $+2.0\ \frac{m}{s2}$ to $90.\ \frac{km}{h}$. How long does this take, and how far does the car travel in this time? 4.1 s / 87 m

10.) A car travelling at $90.0\ \frac{km}{h}$ comes to a stop in $12.0\ s$, what was its acceleration? -2.08 $\frac{m}{s^2}$

11.) A rock is dropped from a bridge and strikes the water below $24.0\ s$ later. With what speed did it strike the water, and from how high up was it dropped? 235 $\frac{m}{s}$ / 2830 m

12.) A bullet is fired upwards from a gun and reaches a maximum height of $2100.m$. What is its velocity at the high point, what was its initial velocity, and how long was it in the air? 0 / +203 $\frac{m}{s}$ / 41.4s

13.) A fastball is thrown upward from the edge of a building with a velocity of $+2.0\ \frac{m}{s}$. If the ball then falls the entire height of the building ($30.0\ m$), with what velocity will it strike the ground? -24 $\frac{m}{s}$

KEY

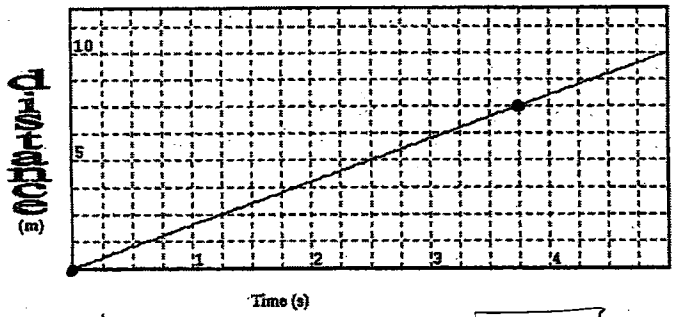
Physics 11 Year End Review

Graphical Analysis Review

1.) On any question with a graph, when not sure you should:

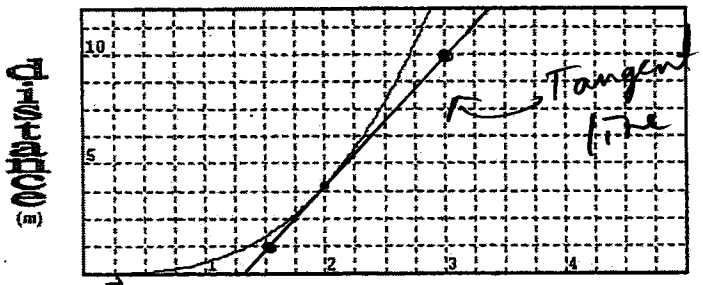
Solve for Slope

2.) Find the velocity on the graph



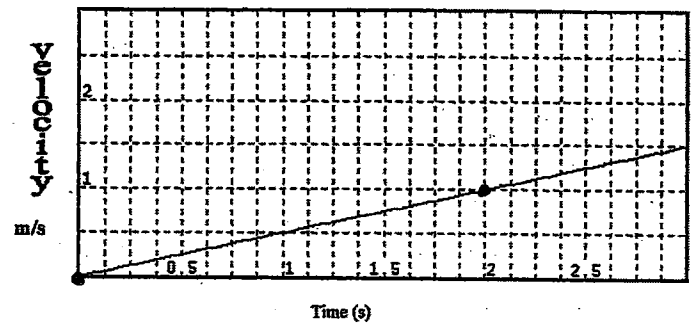
$\text{Slope} = \frac{\Delta d}{\Delta t} = \frac{7.5-0}{3.75-0} = \frac{7.5}{3.75} = +2.0\ \frac{m}{s}$

3.) Find the velocity of the object in the graph below at 2.0 s



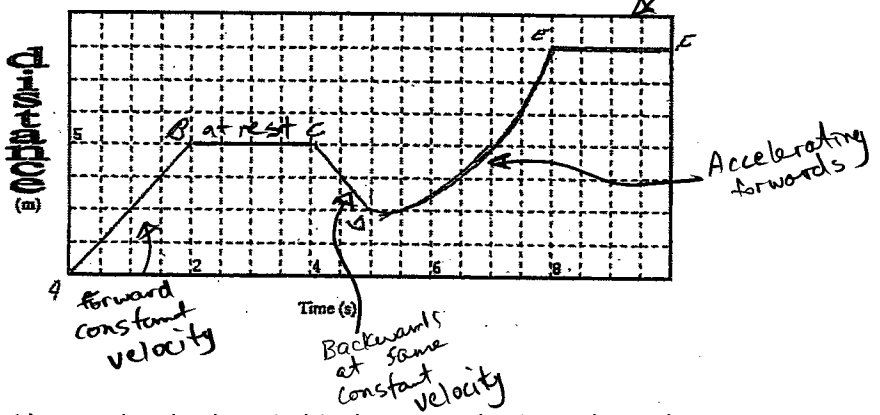
$\frac{\Delta d}{\Delta t} = \frac{10-1.25}{3-1.5} = \frac{8.75}{1.5} = +5.83\ \frac{m}{s}$

4.) Find the acceleration on the graph below, and the displacement.

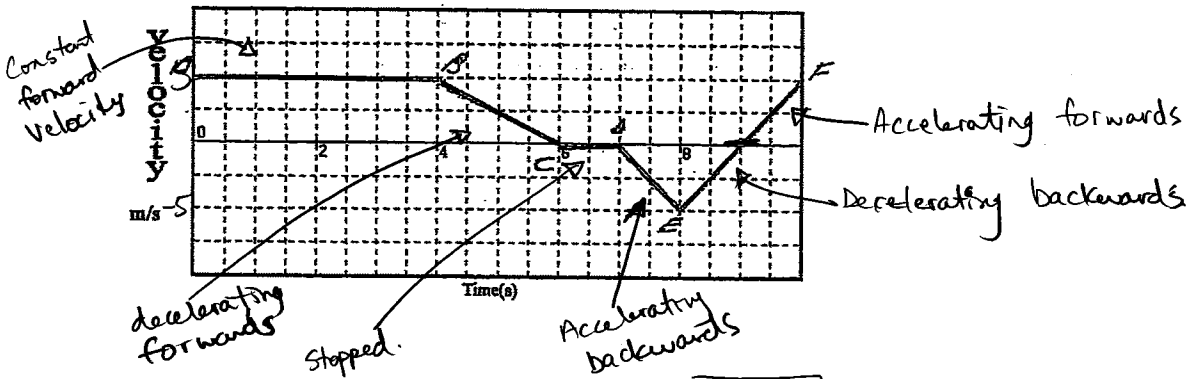


$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{1-0}{2-0} = +0.5\ \frac{m}{s^2}$

5.) Describe what the object is doing between each point on the graph, include direction.

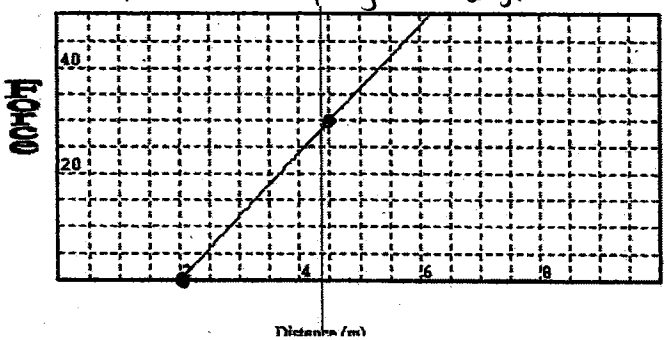


6.) State what the object is doing between each point on the graph.



7.) What is the initial velocity in the previous graph? $+5.0\ \frac{m}{s}$

8.) On the following graph, determine the spring constant with a unit calculation. Why is the x intercept not zero? ← spring has length before being deformed (stretched)



$\vec{F}_e = kx \;/\; \frac{\vec{F}_e}{x} = \text{slope}\ (k)$

$= \frac{30-0}{4.5-2} = \frac{30}{2.5} = 12\ \frac{N}{m}$

KEY

Energy Review

1.) How much energy is require to lift a $50.kg$ mass up to a height of $50.m$ from

a.) the ground? $E_p = mgh = 50 \times 9.81 \times 50 =$ 24500 J

b.) $30.m$ $E_p = mgh = 50 \times 9.81 \times (50-30) =$ 9800 J

2.) What is the kinetic energy of a $50.g$ little brown bat flying at $6.0\frac{m}{s}$? 0.90 J

3.) What is the total energy of the brown bat above if it is at a height of $15\,m$? 8.25 J

4.) If the bat above is shot and falls, what would be its velocity at the ground? $-18.2\frac{m}{s}$

5.) A bag is dropped from a height of $15\,m$, calculate its velocity when it hits the ground, and show that its mass is not important. $E_p = E_K \;/\; mgh = \frac{1}{2}mv^2$ / $-17.1\frac{m}{s}$

6.) A $150.g$ arrow is shot straight up from a bow, at a velocity of $20.\frac{m}{s}$ from a height of $1.5\,m$, To what maximum height will the arrow climb? $E_p + E_K = E_p' \;/\; mgh + \frac{1}{2}mv^2 = mgh'$ / +22m

7.) In the question above, the arrow was seen to rise only to a height of $17.34\,m$. Explain why the law of conservation of energy was NOT violated. → Some energy was converted to heat from air friction.

8.) Calculate the efficiency of the arrow above. $\frac{17.34}{22} \times 100\% =$ 79%

9.) A rollercoaster has a maximum height of $50\,m$ on the first hill, the cars then drop $30.m$, and then finally rises to $10.m$ to the top of the second hill. Calculate the speed of the cars at the top of the second hill (assume the car left the first hill with $\vec{v}_o = 0\frac{m}{s}$. SKIP QUESTION

10.) Re-calculate the above question using an 80% efficiency. $E_p = E_p' + E_K' \;/\; 50 \times 9.81 = 40 \times 9.81 + 0.5v^2$ / $\vec{v} = 14\frac{m}{s}$

11.) A ball of mass $500.g$ falls from a height of $5.0\,m$ and bounces up to a height of $4.0\,m$. What was the efficiency? $\frac{4}{5} \times 100\% =$ 80%

12.) If a ball is thrown down at $14.0\frac{m}{s}$ from $5.0\,m$, to what maximum height could it bounce?

$E_p + E_K = E_p'$

$mgh + \frac{1}{2}mv^2 = mgh'$

$9.81 \times 5 + 0.5 \times 14^2 = 9.81h'$

$h' = 15\,Km$

Work and Power Review

1.) What is the work done when pulling a mass with a force of $+25\,N$ a distance of $10\,m$. 250 J

2.) Calculate the work done when pushing a shovel of snow $3.0\,m$ if the shovel is held at an angle of $30°$ *to the ground*, and a force of $120\,N$ is applied along the handle. 312 J

3.) How much work is done if a $15\,kg$ object is lifted $2.0\,m$ off the ground? 294 J

4.) What is the power used by a student whose mass is $75\,kg$ and runs up $3.0\,m$ in $4.2\,s$? 525 W

5.) How long does it take a $100\,W$ light bulb to consume $75\,J$ of energy? 0.75 s

6.) A plane is flying horizontally using a $15\,000\,N$ force to travel $150.km$. The altitude of the plane is $3\,000\,m$. How much work is done? 2.25×10^9 J

KEY

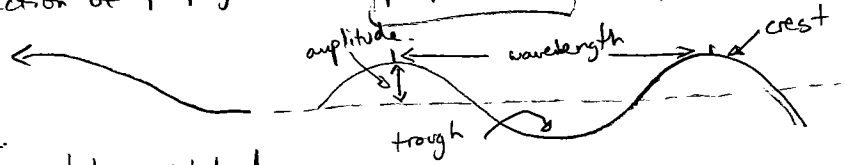
Waves Review

1.) For any wave, the angle of incidence and angle of reflection are Equal

2.) All angles should be measured from: Normal

3.) How are transverse and longitudinal waves similar and different?
Longitude direction of propogation is parallel to particle motion.
Trans direction of propogation is perpendicular to particle motion.

4.) Sketch a transverse wave and label one crest, trough, wavelength, and amplitude.

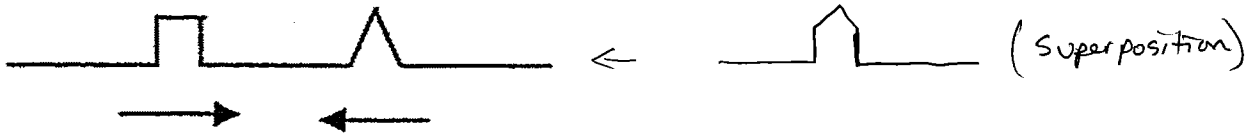


5.) A siren approaches you, as a result of doppler effect its frequency will be higher, wavelength will be shorter, and sound will be high pitched.

6.) After the siren passes you, what will happen to each of these? lower, longer, and low pitched.

7.) What are blue shift and red shift of stars, relate these terms to Doppler effect. ← approaching compress wavelength = blue colour shift
receding stretch wavelength = red colour shift.

8.) Sketch the result of the two pulses meeting, what is the principle called which causes this result?



9.) What happens when a crest meets a trough? Destructive interference

10.) What happens when a crest meets a crest? Constructive interference

11.) Calculate the speed of a wave which travels 15 m in 10. s. $\vec{v} = \frac{d}{t}$ / $\vec{v} = \boxed{1.5\frac{m}{s}}$

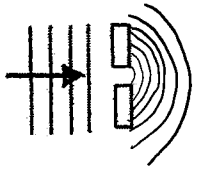
12.) Calculate the speed of a wave which has a wavelength of 2.0 m and frequency of 5.0 Hz. $\vec{v} = \lambda f$ / $\vec{v} = \boxed{10\frac{m}{s}}$

13.) What is the period of the above wave? $T = \frac{1}{f}$ / $\boxed{T = 0.20s}$

14.) Calculate the wavelength of a blue light ray with a frequency of $1.86 \times 10^{6} Hz$. $\lambda = \frac{v}{f}$ / $\lambda = \frac{3.0\times10^{8}}{1.86\times10^{6}}$ / $\boxed{\lambda = 161m}$

15.) Waves on Okanagan Lake pass by a point every 1.5 s. If they travel 20. m in 30. s, find their speed, frequency, and wavelength. $\vec{v} = \frac{d}{t}$ / $\vec{v} = \frac{20}{30}$ / $\vec{v} = 0.67\frac{m}{s}$ $f = \frac{1}{T}$ / $f = \frac{1}{1.5}$ / $f = 0.67s$ $\frac{\vec{v}}{f} = \lambda$ / $\boxed{\lambda = 1m}$

16.) Sketch diffraction as light passes between the opening of a barrier as shown below:



17.) What angle should be between polarizers to block light waves from passing through them? 90° or perpendicular to each other.