Name _____

6) A train whistle is measured to have a loudness of 100 db at a distance of 10m from the train. Assuming that the sound energy spreads out spherically, the loudness measured 40 meters from the train is

a) 88 db

b) 125 db

c) 94 db

d) 106 db

e) 97 db

INTENSITY IS WATTS/M², AREA OF A SPHERE IS $4\pi R^2$ SO IF RADIUS X4 THEN AREA X16 AND INTENSITY $\times \frac{1}{16}$

$100 = 10 \log_{10}(I_{10}/I_0)$ $\quad I_{40}/I_0 = (I_{10}/I_0) \times \frac{1}{16}$

$10 \log\left(\frac{I_{10}}{I_0} \times \frac{1}{16}\right) = 10\{\log(I_{10}/I_0) + \log(\frac{1}{16})\}$

$= 100 + 10 \log \frac{1}{16} = 100 - 12.0 = 88$ dB

7) Ten moles of a monatomic He gas is at an initial temperature of 300K. If the gas absorbs 150,000 J of heat energy while the volume is kept constant, the final temperature of the gas is:

(a) 1503 K

(b) 701 K

(c) 816 K

(d) 1022 K

(e) none of the above

$\Delta U = Q - W$; AT CONST V, $W = 0$

$\Delta U = 150000\ J = \frac{3}{2} n R \Delta T$

(SINCE $U = \frac{3}{2} nRT$)

$\Delta T = 150000/(\frac{3}{2} \times 10 \times 8.31) = 1203K$

8) A hollow cubic box of wood, 1 m on each side, weighs 980 N in air. It is placed in fresh water lake tied to an anchor made of solid iron (1m x 1m x 10cm) with a massless cord of such length that exactly half of the wooden box is submerged. The tension in the cord is:

(a) 8829 N

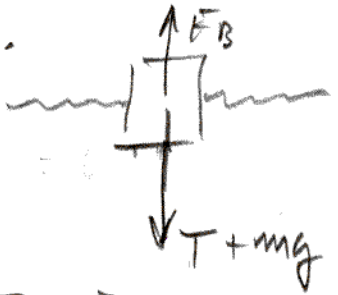
(b) 3920 N

(c) 4900 N

(d) 7644 N

(e) 0 N

THE BOX DISPLACES 1/2 M^3 OF WATER, WHICH WEIGHS $\frac{1}{2} M^3 \times 1000\ kg/M^3 \times 9.8\ m/s^2 = 4900$ N, WHICH IS THE BUOYANT FORCE ON THE BOX. THE BOX WEIGHS 980 N.



THE DOWNWARD FORCE ON THE BOX IS THE TENSION IN THE CORD, T, PLUS ITS WEIGHT $mg = 980$N. THE BOX IS NOT MOVING, SO THE FORCES MUST SUM TO ZERO.

$F_B - T - mg = 0$ OR $T = F_B - mg$

OR $T = 4900 - 980 = 3920$

Name _____

9) Indicate which of the following processes of heat transfer requires a fluid to be involved;

(a) Change of phase ← CHANGE OF PHASE ALWAYS INVOLVES A FLUID BUT THE HEAT TRANSFER THAT CAUSES IT COULD BE BY RADIATION OR CONDUCTION.

(b) Convection ← REQUIRES A SUBSTANCE WHERE THE MOLECULES CAN MOVE FREELY → FLUID.

(c) Radiation

(d) Conduction ← SOLIDS CAN DO THIS

(e) None of the above choices is valid

10) A 100 m long high voltage cable is suspended between two towers. The mass of the 100 m cable is 150 kg. If the tension in the cable is 30,000 N, the lowest frequency at which this cable can oscillate is:

(a) 2.0 Hz

(b) 1.0 Hz

(c) 1.4 Hz

(d) 0.71 Hz

(e) 0.50 Hz

$v = \sqrt{\frac{T}{\mu}}$ $T = 30000\ N$ $\mu = \frac{150\ kg}{100\ m} = 1.5\ \frac{kg}{m}$

$v = \sqrt{\frac{30000}{1.5}} = 141.42\ m/s$

λ FOR LOWEST FREQUENCY IS LARGEST λ SINCE $v = f\lambda$, LARGEST λ IS $\lambda/2 = 100\ m$ SO $\lambda = 200\ m$. THEN

$f = v/\lambda = 141.4/200 = 0.71\ Hz$

11) If two adjacent frequencies of an organ pipe closed at one end are 450 Hz and 550 Hz, the length of the pipe is: *(velocity of sound is 340 m/s)*

(a) 0.85 m

(b) 1.70 m

(c) 1.50 m

(d) 1.27 m

(e) none of the above

FOR A TUBE OPEN AT ONE END $f_n = n\left(\frac{v}{4L}\right)$ WITH n ODD. IF 2 ADJACENT FREQUENCIES ARE 450 AND 550 THEN WE MUST HAVE

$450 = n\left(\frac{v}{4L}\right)$ AND $550 = (n+2)\left(\frac{v}{4L}\right)$

SUBTRACTING, $100 = 2\left(\frac{v}{4L}\right)$ SO

$100 = v/2L$ AND $L = v/2 \cdot 100$

$L = 340/200 = 1.7\ m$

Name _____

12) A trumpeter in the UW band is proud that he can blow with an intensity measured to be 60 db. What is the intensity level that a group of 40 equally capable trumpeters can reach?

(a) 63 db

(b) 66 db

(c) 100 db

(d) 76 db

(e) 240 db

$10 \log_{10}\left(\frac{I}{I_0}\right) = 60$

$10 \log_{10}\left(\frac{I}{I_0} \times 40\right) = 10\left[\log_{10}\left(\frac{I}{I_0}\right) + \log_{10}(40)\right]$

$= 60 + 10\log_{10}(40)$

$= 60 + 16 = 76\ \text{dB}$

13) A sound wave traveling in air has velocity v_0; frequency f_0 and wavelength λ_0, when it encounters a balloon filled with a gas of much greater density than air. Inside the balloon the wave has velocity v_1; frequency f_1 and wavelength λ_1. Indicate the true situation: v IS PROPORTIONAL TO $1/\sqrt{\rho}$ SO IF $\rho\uparrow$, $v\downarrow$; f DOESN'T CHANGE SO $\lambda = v/f \downarrow$ IF $v\downarrow$

(a) The velocity is unchanged $v_1 = v_0$; but the wavelength increases $\lambda_1 > \lambda_0$,

(b) The frequency is unchanged $f_1 = f_0$; but the velocity decreases $v_1 < v_0$ ($v_1 < v_0$)

(c) The frequency is unchanged $f_1 = f_0$; but the wavelength increases $\lambda_1 > \lambda_0$,

(d) The wavelength is unchanged $\lambda_1 = \lambda_0$; but the velocity decreases $v_1 < v_0$, ($v_1 < v_0$)

(e) The velocity is unchanged $v_1 = v_0$; but the wavelength increases $\lambda_1 > \lambda_0$,

14) A worker (weight 800 N) stands on a 4 m long scaffold to work on a billboard. The scaffold (weight 500 N) is supported by vertical ropes at each end. The worker stands 1m from one end. The tension in the rope nearest the worker is:

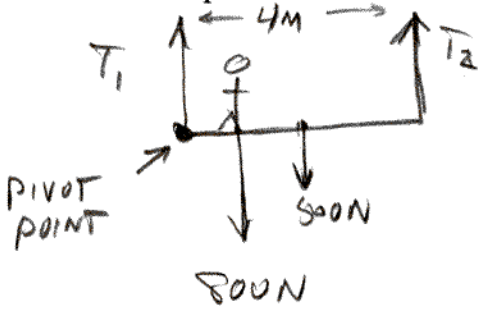
(a) 500 N

(b) 800 N

(c) 450 N

(d) 850 N

(e) 1000 N



THE TORQUE ABOUT THE END NEAR THE WORKER IS $4T_2 - 2(500) - 1(800) = 0$

SO $T_2 = 450$

TOTAL FORCE IS

$T_1 + T_2 - 800 - 500 = 0$

SO $T_1 + 450 = 1300$

$T_1 = 850\ N$

$\frac{1}{2}\rho v_1^2 + \cancel{P} + \rho g h_1 = \frac{1}{2}\rho v_2^2 + \cancel{P} + \rho g h_2$

Name _____ $v_1 = 10$ AND $v_1 A_1 = v_2 A_2$ SO

$A_1 = \pi r_1^2$ $A_2 = \pi r_2^2$ $v_2 = v_1 A_1 / A_2 = v_1 (r_1^2 / r_2^2)$

15) Water (an ideal fluid) flows at 10 m/s through a pipe of radius 3 cm. The pipe goes up to the second floor of the building (2 m higher) and the pressure remains unchanged. The radius of the pipe on the second floor is: $\frac{1}{2} v_1^2 = \frac{1}{2} v_1^2 \left(\frac{r_1^2}{r_2^2}\right)^2 + g(h_2 - h_1)$ ($h_2 - h_1 = 2$ m)

(a) radius = 4.6 cm

(b) radius = 3.4 cm

(c) radius = 1.2 cm

(d) cannot be determined from the information given

(e) radius = 2.6 cm

$\frac{1}{2} 10^2 = \frac{1}{2} 10^2 \left(\frac{r_1}{r_2}\right)^4 + 9.8 \cdot 2$

$50 = 50 \left(\frac{r_1}{r_2}\right)^4 + 19.6$; $\left(\frac{r_1}{r_2}\right)^4 = \frac{50 - 19.6}{50}$

$\left(\frac{r_1}{r_2}\right)^4 = 0.608$; $\frac{r_1}{r_2} = 0.883$; $r_2 = \frac{3\text{ cm}}{0.883}$

16) A block of wood is floating partially submerged in large pail of water. It is placed on the floor of an elevator. As the elevator accelerates upward, the block of wood

(a) sinks

(b) rises

(c) remains submerged at the same level

(d) none of the above

(e) cannot be predicted

IF THE ELEVATOR ACCELERATES UPWARD WITH ACCELERATION a, THE WEIGHT OF EVERYTHING IN IT IS EFFECTIVELY $m(g+a)$. THIS GOES FOR BOTH THE BLOCK OF WOOD AND THE WATER IT DISPLACES. SO IN ORDER TO DISPLACE ITS OWN WEIGHT OF WATER, IT DISPLACES EXACTLY AS MUCH AS IT DID IN THE ELEVATOR WITH NO ACCELERATION.

17) When you stand half way between two loudspeakers, with one on your left and one on your right, a musical note from the speakers gives you constructive interference. How far to your left should you move to obtain destructive interference?

(a) one and a half wavelengths

(b) half a wavelength

(c) a quarter of a wavelength

(d) one wave length

(e) not move at all

YOU ARE AN EQUAL NUMBER OF WAVELENGTHS FROM EACH SPEAKER. IF YOU MOVE $\frac{1}{4}\lambda$ ($\frac{1}{4}$ WAVELENGTH) YOU WILL BE $\frac{1}{4}\lambda$ CLOSER ON ONE SIDE AND $\frac{1}{4}\lambda$ FARTHER ON THE OTHER, SO THE PATH ON ONE SIDE WILL BE $\frac{1}{2}\lambda$ LONGER $\Rightarrow$ DESTRUCTIVE INTERFERENCE

Name _____

18) A violinist tunes his instrument using a 440 Hz tuning fork. At one moment he perceives a beat frequency of 7 Hz. She tunes the string by increasing the tension. The frequency of vibration of his string was (before tuning):

FOR SOLUTIONS TO OTHER VERSIONS OF THIS PROBLEM, SEE THE LAST PAGE.

(a) exactly 447 Hz

(b) exactly 433 Hz

(c) either 433 Hz or 447 Hz

(d) exactly 880 Hz

(e) both 433 Hz and 447 Hz

$v = \sqrt{\frac{T}{\mu}} = f\lambda$ λ IS FIXED SO IF T↑, f↑. THUS f MUST HAVE BEEN TOO LOW; TO BEAT AT 7Hz IT MUST HAVE BEEN $440 - 7 = 433$ Hz

19) You are a passenger on a hot air balloon that is rising with constant velocity and you are carrying a cell phone that rings with a sound of frequency f. As you open it, you drop it and it falls to earth still ringing. As it is falling you note that the ringing:

(a) increases in frequency and intensity.

(b) decreases in frequency and intensity.

(c) decreases in frequency and the intensity increases.

(d) increases in frequency and the intensity decreases.

(e) maintains its frequency and intensity unchanged.

IT'S GETTING FARTHER AWAY SO THE INTENSITY DECREASES. IT ALSO DOPPLER SHIFTS; $f' = f\frac{v}{v - v_s}$ (MOVING SOURCE) v_s IS NEGATIVE AND INCREASING IN MAGNITUDE SO f' ↓

20) Sunlight falls on the Earth delivering energy E to the earth every day. The Earth is at a temperature of 18 ^{0}C while the Sun has surface temperature 5000 ^{0}C. The Earth radiates an energy W away to outer space each day. Indicate which of the following statements is true;

a.) W = E and the entropy received from the Sun is > the entropy exported from the Earth.

b.) W < E and the entropy received from the Sun is < the entropy exported from the Earth.

c.) W = E and the entropy received from the Sun is < the entropy exported from the Earth.

d.) W > E and the entropy received from the Sun is = the entropy exported from the Earth.

e.) W < E and the entropy received from the Sun is > the entropy exported from the Earth.

TEMP. OF EARTH REMAINS CONSTANT AND NO WORK IS BEING DONE, SO EARTH MUST BE LOSING ENERGY AS FAST AS IT IS GAINING IT (SINCE, UNLIKE THE SUN, IT PRODUCES NO HEAT.). $\Delta S = \Delta Q/T$; T_{EARTH} IS SMALLER SO ΔS_{EARTH} IS GREATER

Name _____

21) A rock is thrown straight up from the Earth's surface. Indicate which one of the following statements concerning the rock at the top of its path is false:

a.) The net force acting on the rock is down and constant. TRUE

b.) Its velocity is zero. TRUE

c.) Its vertical position is at maximum. TRUE

d.) Its kinetic energy is zero. TRUE

e.) Its acceleration is zero. — NO, ACCELERATION IS ALWAYS $g \downarrow$.

22) Two canoes are 10 m apart on Lake Mendota. A student observes that her canoe bobs up and down and up again 6 times in one minute. When one canoe is at its lowest point, the other is at the highest. Both canoes are within a single cycle of the waves. The wave velocity is:

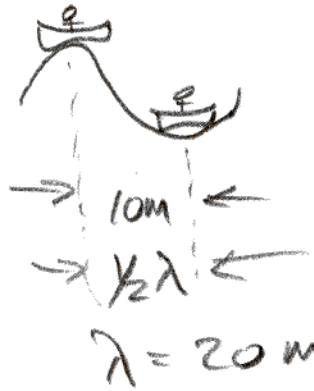
a.) 1.4 m/s

b.) 2.0 m/s

c.) 5.0 m/s

d.) 0.5 m/s

e.) 0.7 m/s



$f = 6$ PER MINUTE $= 6/60\,s = \frac{1}{10}$ Hz

$v = f\lambda$

$v = \frac{1}{10}(20) = 2.0$

23) A 2 kg ball has zero kinetic and potential energy. Alfred drops the ball into a 20 m deep well. Just before the ball hits the bottom, the sum of its kinetic and potential energy is:

(a) 392 J

(b) -392 J

(c) 784 J

(d) zero

(e) 196 J

THE BALL LOSES AS MUCH IN POTENTIAL ENERGY AS IT GAINS IN KINETIC (THAT'S CONSERVATION), IF YOU CHOOSE h = ZERO AT THE TOP OF THE WELL (GROUND LEVEL, AS USUAL) THEN $PE = mgh$ IS NEGATIVE AT THE BOTTOM BECAUSE h IS NEGATIVE AT THE BOTTOM.

Name _____

24) George drives a truck with a flat cargo bay horizontally at 15 m/s. He is transporting a crate of delicate lead crystal. If the coefficient of static friction between the crate and the truck bed is 0.4, the minimum stopping distance for the truck so that the crate will not slide is:

(a) 28.7 m

(b) 51.0 m

(c) 33.6 m

(d) 44.4 m

(e) 20.1 m

IF THE TRUCK STOPS IN DISTANCE x, ITS ACCELERATION a IS GIVEN BY

$v_f^2 = 0 = v_0^2 + 2ax = 15^2 + 2ax$ SO

$a = \frac{225}{2x}$. THE FRICTION $f = \mu N = \mu mg$ MUST SUPPLY THIS ACCELERATION, SO

$a = \frac{f}{m} = \mu g = \frac{225}{2x}$; $x = \frac{225}{2\mu g} = \frac{225}{2 \times .4 \times 9.8}$

$x = 28.7$ m

25) A package of mass m = 2 kg is released from rest at a height 2 m above the floor and slides along a track inclined at an angle of 45^0 to the horizontal. The coefficient of sliding friction between the track and package is 0.33. Its velocity as it reaches the bottom is:

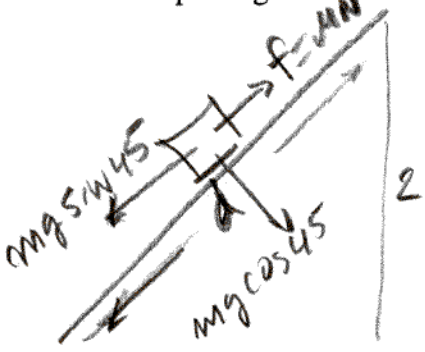
a.) 3.65 m/s

b.) 2.6 m/s

c.) 7.29 m/s

d.) 5.11 m/s

e.) 10.03 m/s



$N = mg\cos 45^\circ = 2 \cdot 9.8 \cos 45^\circ = 13.86$

$\mu N = 4.57$

$mg \sin 45 = 13.86$ SO THE FORCE ACCELERATING THE CRATE IS

$13.86 - 4.57 = 9.29\ N = ma$

$a = 9.29/2 = 4.64\ m/s^2$ $(m = 2)$

$\sin 45 = \frac{2}{d}$ SO $d = \frac{2}{\sin 45^\circ} = 2.828$, $v_f^2 = v_0^2 + 2ad = 26.75$

26) Ten moles each of neon (m = 20) and helium (m = 4) gas are at thermal equilibrium at temperature 17 ^{0}C in a 2 m^3 volume. The ratio of the rms velocity of neon to that of helium is:

a.) 0.45

b.) 0.20

c.) 5.00

d.) 2.24

e.) not calculable

$v_{rms} = \sqrt{\frac{3kT}{m}}$ $\frac{v_{Ne}}{v_{He}} = \frac{\sqrt{3kT/m_{Ne}}}{\sqrt{3kT/m_{He}}} = \sqrt{\frac{m_{He}}{m_{Ne}}}$

$\frac{v_{Ne}}{v_{He}} = \sqrt{\frac{4}{20}} = \sqrt{\frac{1}{5}} = 0.45$

Name _____

27) A "grandfather's" clock is based on a pendulum of length exactly 1 m at temperature 30 ^{0}C. If the clock is taken to a location at –20 ^{0}C the clock

a.) is unchanged

b.) gains a little bit each day

c.) loses a little bit each day

d.) becomes inoperative

e.) stops.

COLDER TEMP. MAKES THE PENDULUM CONTRACT, IF IT IS SHORTER $T = 2\pi\sqrt{\frac{\ell}{g}}$ IS SHORTER AND IT RUNS TOO FAST.
(SAME ANSWER IN VERSION ABEDC OF THIS EXAM)

28) A phonograph record of moment of inertia I_0 is initially at rest and falls on the rotating turntable (moment of inertia I_1) which is rotating with angular velocity ω_1. Because the surfaces are rough the two eventually reach the same angular speed ω. The ratio of ω_1 to ω is

a.) I_1/I_0

b.) I_0/I_1

c.) $(I_0+I_1)/I_1$

d.) $(I_0+I_1)/I_0$

e.) $I_0/(I_0+I_1)$

ANGULAR MOMENTUM IS CONSERVED:

$L_i = I_1\omega_1$ INITIALLY

$L_f = (I_1+I_0)\omega$ FINALLY

} AND THEY ARE EQUAL

$I_1\omega_1 = (I_1+I_0)\omega$ SO $\frac{\omega_1}{\omega} = \frac{I_1+I_0}{I_1}$

29) Which of the following is not an example of convective heat transfer:

a.) Boiling water in a pan — ON AN ELECTRIC STOVE → MOSTLY CONDUCTION BUT ON A GAS STOVE → MOSTLY CONVECTION

b.) A sailplane circling in the sky — FLOATS ON RISING AIR CURRENTS FROM CONVECTION

c.) A southerly wind — WIND IS CONVECTION

d.) A sunburn — THIS IS RADIATION

e.) A "drafty" room — WIND AGAIN

Name _____

30) If the amplitude of a system moving in simple harmonic motion is reduced by half, which statement is false:

a.) The total energy is halved $E = \frac{1}{2}kA^2$; $A \times \frac{1}{2} \Rightarrow E \times \frac{1}{4}$ FALSE.

b.) The period is unchanged. TRUE $T \propto \sqrt{m/k}$

c.) The frequency is unchanged TRUE $f \propto \sqrt{k/m}$

d.) The maximum speed is halved ωA IS HALF IF A IS HALF

e.) The maximum acceleration is halved $\omega^2 A$ " " "

31) Three balls are thrown with exactly the same speed from the top of a building of height H. Ball A is thrown upwards at 30^0 to horizontal, ball B is thrown horizontally, and ball C is thrown down at 30^0 to the horizontal. Neglecting air resistance, which statement is true. THE FINAL KE IS THE INITIAL KE + PE GAINED (mgH) IN THE FALL, WHICH IS THE SAME FOR ALL 3 BALLS.

a.) All the balls strike the ground with the same speed.

b.) Ball C strikes the ground with the highest speed, then B, then A.

c.) Ball C strikes the ground with the highest speed, then A, then B.

d.) Ball A strikes the ground with the highest speed then B, then C

e.) Ball A strikes the ground with the highest speed then C, then B

32) Two cars, one in front of the other, are traveling down the highway at 25 m/s. The car behind sounds its horn, which has a frequency of 500 Hz. The frequency of the sound heard by the driver of the lead car is:

a.) 463 Hz

b.) 540 Hz

c.) 579 Hz

d.) 500 Hz

e.) 427 Hz

THE SOUND IN THE AIR IS AT $f' = f\frac{v}{v - v_s}$,
THE SOUND HEARD FROM A MOVING SOURCE,
WHEN THIS SOUND IS HEARD BY A MOVING OBSERVER IT IS HEARD AS $f'' = f'\frac{v + v_o}{v}$.
$v_s = +25$ m/s SINCE THE SOURCE IS MOVING TOWARD THE OBSERVER. $v_o = -25$ m/s SINCE THE OBSERVER IS MOVING AWAY FROM THE SOURCE. SO $f'' = \left(f\left(\frac{v}{v-25}\right)\right)\left(\frac{v-25}{v}\right) = f$

Name _____

33) A fireperson is 50 m from a burning building and directs a stream of water from a fire hose at an angle of 30^0 above the horizontal. If the initial speed of the stream is 40 m/s the height that the stream of water will strike the building is:

HORIZONTAL VELOCITY $v_x = v\cos 30° = 40\cos 30$

TRAVEL TIME $= x/v_x = 50/40\cos 30 = t$

HEIGHT AT t IS $h = v_y t + \frac{a_y t^2}{2}$, $v_y = v\sin 30°$

$h = (40\sin 30)\left(\frac{50}{40\cos 30}\right) - \frac{9.8}{2}\left(\frac{50}{40\cos 30}\right)^2$

$h = 28.87 - 10.21 = 18.66$ m

(a) 9.6 m

(b) 13.4 m

(c) 18.7 m

(d) 22.4 m

(e) 30.0 m

34) You are lifting a book to a shelf of a bookcase. You can take the book to the shelf by various paths. Which one of the following statements is true:

(a) Work done on the book depends on the path taken by book. NO - ALWAYS mgh

(b) Work done on the book depends on the time taken to move it. NO " "

(c) The power required depends on the mass of the book and the height of the book shelf only. NO - ALSO ON HOW FAST YOU MOVE IT.

(d) The power required varies depending on the path taken, if you move the book at constant speed along various paths. YES. $P = F \cdot v$ AND F DOESN'T DEPEND ON THE PATH.

(e) No work is done on the book at all. NO - mgh IS DONE

35) A heavily loaded boat is floating in a small shallow pond. The boat springs a leak and sinks. The surface level of the pond:

a) stays the same

b) goes higher

c) goes lower

d) more information is needed to reach a conclusion.

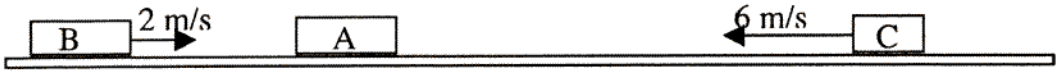
e) depends on the depth of the pond

THE BOAT & ITS LOAD DISPLACE THEIR OWN WEIGHT OF WATER, WHICH FLOATS. AFTER THE BOAT & THE LOAD SINK THEY DISPLACE THEIR OWN VOLUME OF WATER, WHICH MUST WEIGH LESS THAN THEY DO, OR THEY WOULD FLOAT. SO THEY DISPLACE LESS WATER AFTER THEY SINK.

Name _____

The following three questions pertain to the situation described below:

Three carts are on a frictionless air track as shown. One (A) of mass 1500 g. is at rest and a similar one (B) also of mass 1500 g is moving toward it at 2 m/s. They make a completely inelastic collision and then they (as a unit) collide inelastically with a third cart (C) of mass 500 g. which is moving toward the pair with speed 6 m/s.



36) The velocity of the pair A-B after their collision is:

a.) 2.0 m/s

b.) 1.5 m/s

c.) 1.0 m/s

d.) 0.5 m/s

e.) 0.0 m/s

MOMENTUM IS CONSERVED. THE MASS IS DOUBLE AFTER THE COLLISION SO THE VELOCITY MUST BE HALF.

37) The velocity of the group A-B-C after the collision is:

a.) 2.0 m/s

b.) 1.5 m/s

c.) 1.0 m/s

d.) 0.5 m/s

e.) 0.0 m/s

NOW YOU HAVE $3.000\,kg \times 1\,m/s - 0.500\,kg \times 6\,m/s$ OR ZERO MOMENTUM

38) The amount of the initial kinetic energy (A and B and C) lost to heat in the two collisions is:

a.) 1.5 J

b.) 12.0 J

c.) 3.0 J

d.) 6.0 J

e.) 24.0 J

AT THE END THERE IS NO MOTION & NO KE,

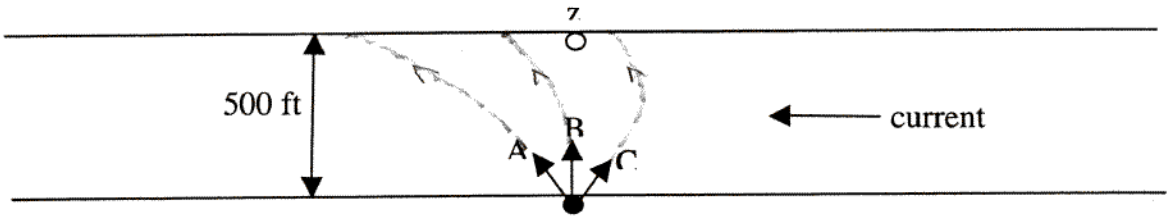
AT THE BEGINNING WAS $\frac{1}{2}(1.5\,kg)(2\,m/s)^2 +$

$+ \frac{1}{2}(0.5\,kg)(6\,m/s)^2$

OR $\frac{1}{2}(1.5)(4) + \frac{1}{2}(0.5)(36) = 3 + 9 = 12\,J$

Name _____

Three swimmers Alma, Betty and Carol, *all* of whom swim at the same ~~velocity~~ SPEED through the water (3 mph) set out for the other side of a river which is 500 ft across and has a current of 1 mph as shown.



39) Which of the swimmers will reach the other side farthest from the point z directly opposite the starting point?

a.) Alma

b.) Betty

c.) Carol

d.) All will fail to get to the other side

e.) All will reach the other side simultaneously.

40) Which of the swimmers will reach the other side in the shortest time, irrespective of their final location.

a.) Alma

b.) Betty

c.) Carol

d.) All will fail to get to the other side

e.) All will reach the other side simultaneously.

BETTY HAS THE HIGHEST CROSSWISE COMPONENT OF VELOCITY BECAUSE ALL OF HER SPEED IS IN THE CROSSWISE DIRECTION. TIME TO CROSS IS (500 FT)/(CROSSWISE VELOCITY) SO THE HIGHEST CROSSWISE VELOCITY WINS.

Name _____

PROBLEM IS IN VERSION ABEDC:

THE ANSWER IS C) BECAUSE EITHER OF THESE FREQUENCIES COULD GIVE 7HZ BEATS.

UNLIKE THIS VERSION OF THE TEST, ABEDC DOES NOT SAY THE STRING WAS TUNED BY TIGHTENING IT, SO WE DO NOT KNOW THE PITCH HAD TO BE RAISED TO BE IN TUNE. IT COULD HAVE BEEN LOWERED.

IN VERSION ECBDA, THE PITCH WAS LOWERED BY DECREASING THE TENSION, SO WE KNOW IT MUST HAVE BEEN HIGHER BEFORE IT WAS TUNED. THUS ANSWER a) IS CORRECT HERE.