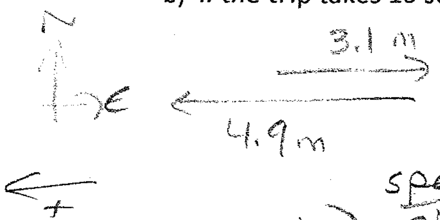
Mini Practice Exam **Name:** ______________________

1. If a bee flies 3.1 m [E] and then 4.9 m [W], calculate:
   a) resultant distance and displacement of the bee
   b) if the trip takes 10 seconds, determine the average speed and average velocity.



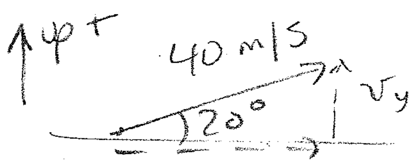
a) $\Delta d = 3.1 + 4.9 = 8.0\ m$ distance

$\Delta \vec{d} = (-3.1) + 4.9 = 1.8\ m\ [W]$ displacement

b) speed $v = \frac{\Delta d}{t} = \frac{8}{10} = 0.8\ m/s$

velocity $\vec{v} = \frac{\Delta \vec{d}}{t} = \frac{1.8\ m\ [W]}{10} = 0.18\ m/s\ [W]$

2. A hockey player on a frozen pond shoots a puck with an initial velocity of 40 m/s, 20° above horizontal.
a) Draw this vector and determine the horizontal and vertical components of initial velocity.



$v_y = (\sin 20)(40) = 13.7\ m/s\ [up]$

$v_x = (\cos 20)(40) = 37.6\ m/s\ [fwd]$

$a = -9.8\ m/s^2$ down

b) How long does the puck stay in the air?

$v_1 = 13.7\ m/s$

$\Delta d = 0$

$a = -9.8\ m/s^2$

$d = v_1 t + \frac{1}{2}at^2$

$0 = 13.7t + (\frac{1}{2})(-9.8)t^2$

$-13.7 = -4.9t$

$t = 2.8\ s$

In air for 2.8 s

c) How far does the puck travel horizontally (assuming it lands in a snow bank and does NOT slide)?

$t = 2.8\ s$

$v_x = 37.6\ m/s$ (constant)

$d = vt$

$d = (37.6)(2.8)$

$d = 105\ m\ [fwd]$

3. You want to ove a 40.0 kg desk to a different corner of your room. If the coefficient of static friction with the floor is 0.30 and the coefficient of kinetic friction is 0.25,
   a) How much force must you exert on the desk to make it slide?

$F_N = F_g = mg = 40\ kg \times 9.8\ N/kg = 392\ N$

$F_a = F_{s\,max}$ $\quad F_{s\,max} = \mu_s F_N = (0.30)(392)$ $\quad F_{s\,max} = 118\ N$

∴ Must push with 118 N

   b) How much force must you continue to exert to move the desk at constant velocity to its destination?

$F_a = F_k$ $\quad F_k = \mu_k F_N = (0.25)(392) = 98\ N$

Push with 98 N

4. a) How much power is produced by a runner who transforms 32kJ of (stored) chemical energy into kinetic and thermal energy in 16s during a sprint?

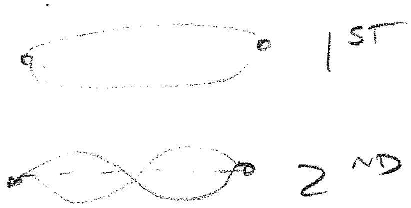
$P = \frac{E}{t} = \frac{32000}{16} = 2000$ Watts

b) Of the 32 kJ converted, 14 kJ was thermal energy. Assuming the goal of sprinting is to run (ya!), what is the efficiency of this transformation?

$\% \text{ eff} = \frac{E_{out}}{E_{IN}} \times 100\% = \frac{18}{32} \times 100\% = 56\%$ efficien[cy]

32 kJ − 14 kJ (heat) = 18 kJ for sprinting

5. a) Draw a guitar string vibrating in its first and second harmonic.

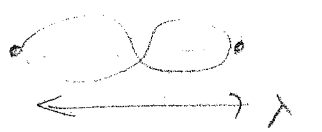


b) If the length of the guitar string is 17 cm, what is the wavelength of the 2nd harmonic?

If you know how

L = 0.17 m

λ = 17 cm



Length = Length
1λ = 17 cm
$\therefore \lambda$ = 17 cm

$L_n = \frac{n\lambda}{2}$ or

6. What did Oersted's experiment prove?

a) Magnetic fields create electric current
b) An electric current in a conductor creates a magnetic field that is perpendicular to the current.
c) An electric current in a conductor creates a magnetic field that is parallel to the current.
d) All conductors have circular-shaped magnetic fields surrounding them.

7. a) If an electromagnet has a lifting force of 150 N, what would happen if I doubled the number of coils (and kept the length of electromagnet the same)?

$\therefore$ double Fmag − lift 150×2 = 300 N

b) What else can I do to change the strength of the electromagnet? (Explain the effect)

✓ - Increase current $\therefore \uparrow$ Fmag
✓ - reverse current $\therefore$ reverse direction of Fmag
- add soft iron core: ↑ strength