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Physics 11 Review Assignment Key

Measurement

1. Write in scientific notation, using the correct number of sig. figs

   a) $0.0032 = 3.2 \times 10^{-3}$

   b) $1.01 = 1.01 \times 10^{0}$

   c) $101 = 1.01 \times 10^{2}$

2. Convert the following to base units

   a) 150 km/h = 42 m/s

   b) 503 micrometers = 0.000503 m

   c) 1.21 GigaWatts!? = 1 210 000 000 W

1.21 gigawatts ???

DANGER

FLUX CAPACITOR
1.21
GIGAWATTS

3. Explain the difference between

   a) A scalar (magnitude only) and a vector (has a direction)

   b) The independent (choose) and the dependent variable (want to find out)

4. Sketch the graph of displacement vs time for a baseball pitch.

5. Describe the motion of a particle if it has the following slope on a velocity time graph

   a) Horizontal (constant velocity)

   b) Positive (constant acceleration)

   c) Negative (constant negative acceleration)

Newton's Laws

1. Explain Newton's laws in your own words

   First: objects travel at constant velocity
   Second: F=ma
   Third: Equal and opposite reaction force

2. Student B. (100kg) stands to the right of Student A. (75 kg) on a frictionless surface. One pushes on the other with a force of 80 N.

   a) Draw a free diagram to show the forces on Student A

b) Find each student's acceleration

$F=ma$
$a=F/m=80N/75kg=1.1$ m/s^2
$a=F/m=80N/100kg=0.8$ m/s^2

3. A car with mass 1880 kg accelerates from a stop light with an acceleration of 8 m/s^2.
   a) What is the net force that causes this acceleration?

$F=ma=1880x8=15000$ N
   b) Four more students with a total mass of 350 kg get in the car for the next light. Assuming the Net force is the same, what will the acceleration be pulling away from the next stop light?

$A=F/m=15000N/2230kg=6.7m/s^2$

4. Weight:
   a) What is the weight of a 60kg student?
   $F=mg=60x9.8=588N$
   b) What is her weight when she is holding a 10kg bag of tricks?
   588N
   c) What is the normal force acting on her from the ground? Why is this different from b?
   588+98=686N because the ground reaction force must balance all forces
   d) What is the weight of the same student on Mars, which has only 1/2 the gravitational field strength of the Earth's?
   60x4.9=294N
5. A student has a mass of 75 kg.
   a) What is the net force acting on him as he jumps, applying a force of 1600N?
   $F_g=mg=-735N$
   $F_{net}=F_g+R=-735N+1600N=865N$
   b) Draw a free body diagram showing all the forces acting on him.
   c) What is the net force acting on him if he applies a force of 350N against the ground? What is his acceleration?
   $F_{net}=F_g+R=-735N+350N=-385N$
   $a=F/m=-385/75=-5.1m/s^2$
6. The coefficient of static friction between your 2kg textbook and your desk is 0.6. The coefficient of kinetic friction is 0.35.
   a) What is the force of static friction acting on your book if you apply a horizontal force of 2N?
   2N
   b) What force is necessary to slide the book on the desk at a constant velocity?
   $Ff=\mu R=0.35x2x9.8=6.86N$
   c) If the book is travelling at 2.5 m/s, how long does it take for the book to come to rest once you stop applying a force to it?
   $a=F/m=6.86/2=3.43m/s^2$
   $t=\Delta v/a=2.5/3.43=0.73s$
7. A rock is thrown horizontally off a 10m cliff. How long does it take to hit the ground?

$t=\sqrt{(2s/a)}==\sqrt{(20/9.8)}=1.4s$

Energy

1. What is the kinetic energy of a 5 kg cart travelling at 6.5 m/s?
   106J
2. A golf ball of mass 35 g is given a velocity of 54 m/s.
   a) How high can it reach? 148m
   b) If it only reaches a height of 88m, how much energy was converted to heat?
   21J

3. A student climbs a rope in 1.50 s. If her mass is 65 kg and the rope is 3.8 m high
   a) How much work did she do? 2.4 kJ
   b) How powerful is she in Watts? 1.6 kW

4. How much work is done by a 75 kg student carrying a 34 kg bag of tricks in the basket of his 22 kg bicycle a distance of 34 m over flat ground in 12 s? 0 J

5. What is the total kinetic energy in the question above? 526 J

6. How high could the student above coast up a hill? 0.41 m

7. Use the following diagram to answer:

| 20.5 m | | 3.8 m |

980 N

500kg
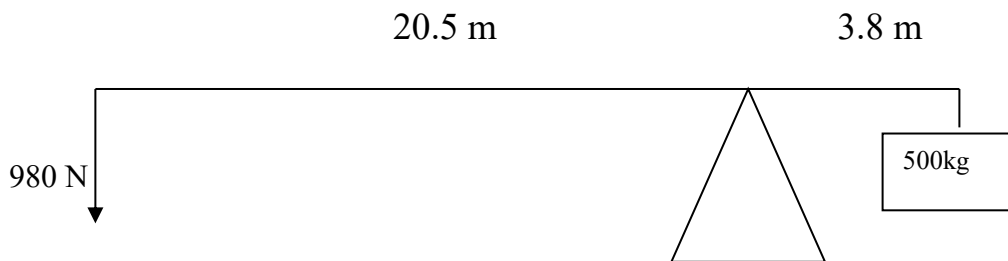
   a) What is the MA of this lever?
   500*9.8/980=5
   b) What is the IMA?
   20.5/3.8=5.4
   c) What is the efficiency?
   5/5.4=93%

8. How efficient is a light bulb that converts 60 W of electrical energy into 3.2 W of light?
   5.3%

9. How much heat energy does the light bulb above produce in 35 minutes?
   94.6%(60)35(60)=119 kJ

10. How much power is necessary to charge the 100
   kWh battery of a Tesla Model X in 15 minutes?
    100(3.6MJ)/900s=400kW

11. How much energy is required to heat a 15.0 kg pot
    of water from 22 C to 99 C?
 $Q=mc\Delta T=15 \times 4180 \times 77=4.8$ MJ

12. What is the specific heat of an unknown substance if it takes 10 kg of the substance at
    100 C to raise the temperature of 10 L of room temperature water by 6 degrees?
    $c=- mc\Delta T/(m\Delta T)=338$ J kg^{-1}K^{-1}

Waves

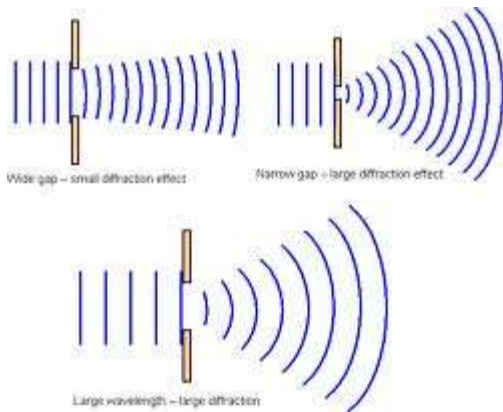1. Draw two interfering waves, and the resultant wave that you would see at this instant.
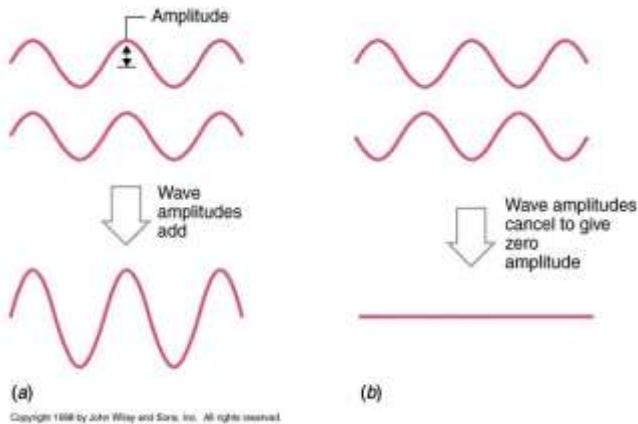
2. Using a picture, describe how the Doppler effect can change the sound you hear from
   a moving ambulance
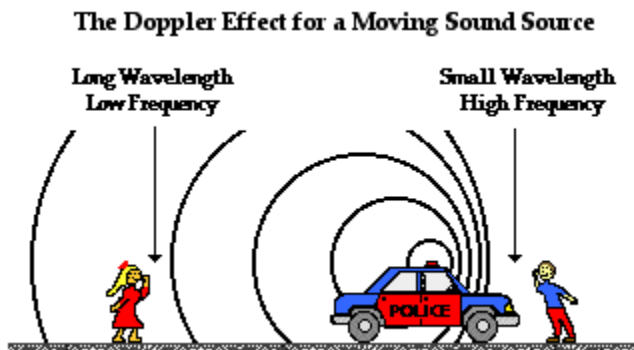
3. Describe the conditions for maximum diffraction of waves passing through an
   opening and draw a sketch to show what this looks like

Wide gap – small diffraction effect   Narrow gap – large diffraction effect

Large wavelength – large diffraction

4. What is the frequency of a sound wave with wavelength 0.10 m if sound travels at 340 m/s? $f=v/\lambda=3400Hz$

5. What is the wavelength of radio NL, if the radio waves have a frequency of 610 kHz?
   $v=f\lambda$
   $\lambda=c/f=3\times10^8/610\times10^3 = 491$ m

6. A laser beam is incident on a piece of glass at an angle of 30° to the normal. The index of refraction for this glass is 1.42
   a) Draw a diagram to show what happens to the beam of light

Angle of Incidence, α
Index of Refraction n_1
Index of Refraction n_2
Angle of Refraction, β
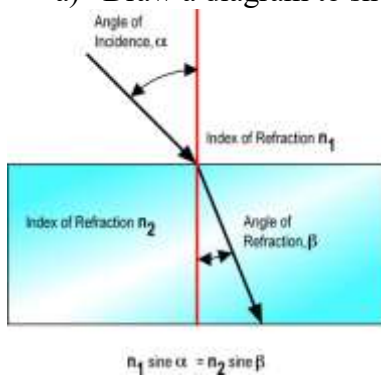
$n_1 \sin\alpha = n_2 \sin\beta$
   b) Use Snell's law to find what the refracted angle will be
   $n_1\sin\theta_1= n_2\sin\theta_2$
   $\theta_2= \sin^{-1}(n_1\sin\theta_1/ n_2)=30.2°$

   c) At what speed will the light be travelling in the glass?
      $n=c0/c$
      $c=c0/n=2.1E8m/s$

7. Describe, using a diagram, how polarized lenses reduce glare from wet surfaces

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unpolarized light

glasses transmit only vertically polarized light

glare greatly reduced

direct light not reduced as much as glare

light partially polarized in the horizontal plane by reflection