Pretest 3.6 STE Answers

Physics Review

1. a) What is the work performed by a horse pulling a carriage with an 8 N force over a 2 km distance?

W = F*d

= 8 N *2000m = 16 000 J

b) What two assumptions regarding applied force and friction did you make in solving the above problem?

We're assuming that the force of 8N is in the same direction as the motion of the carriage. And we are also assuming there's no friction.

2. A large book is placed on a table used for drawing. The table is tilted at 60.0 ^{o} and the book's weight is 45N. What is the effective force that causes the book to slide down the table. First draw what is being described.

$F_{effective} = mg\sin\theta$

But mg = weight = 45N

$F_{effective} = 45\ N \sin 60 = 39\ N$

3. After the prom at the Vaudreuil Castle, which is not really a castle, Joe refuses to drive fast. He doesn't want to crash because he enjoys kissing his girl friend and solving physics problems. To convince his friends to be cautious, he urges them to calculate the ratio of kinetic energy of his 2000 kg vehicle moving at 120 km/h versus his vehicle moving at 80 km/h.

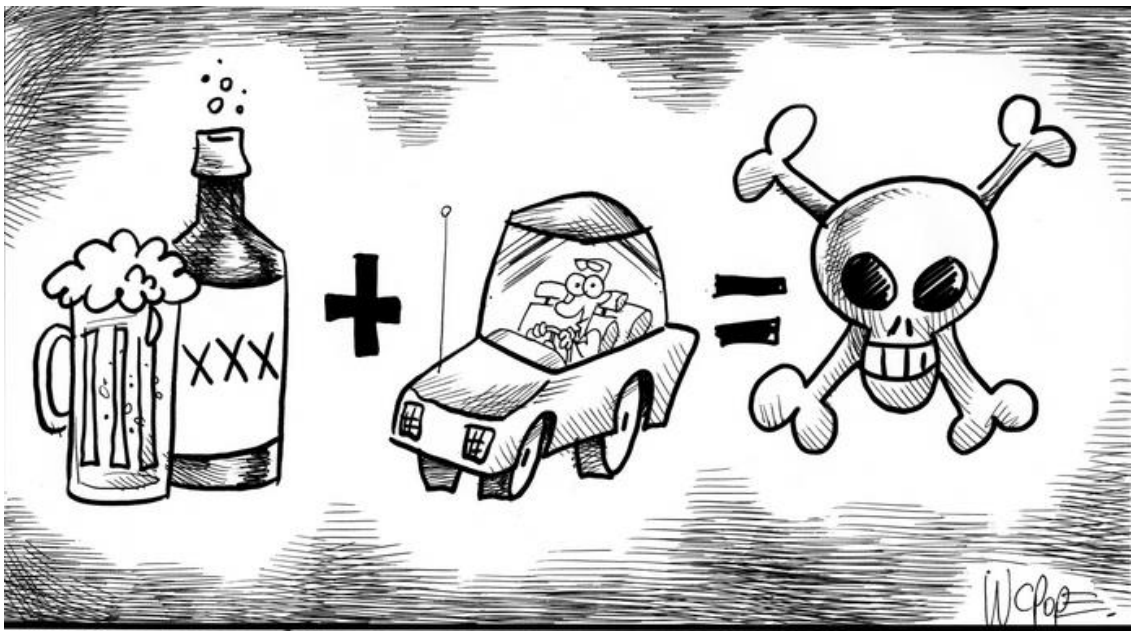
a) Calculate that ratio.

$$\frac{E_1}{E_2} = \frac{0.5\,mv_1^2}{0.5\,mv_2^2} = \frac{v_1^2}{v_2^2} = \frac{\left(120\,\frac{km}{h}\right)^2}{\left(80\,\frac{km}{h}\right)^2} * \frac{\left(1000\,\frac{m}{3600s}\right)^2}{\left(1000\,\frac{m}{3600s}\right)^2} = \frac{(120\ )^2}{(80\ )^2}$$

$$= 2.25\ or\ \frac{9}{4}$$

b) In case of a collision, how much more force of impact will his car have at 120 km/h compared to 80 km/h?

Since work is energy, which = F*d, over the same distance it will have about 2.25 times the collision force. When the same breaking force is applied to the faster car, it will need 2.25 times more distance to come to a stop!



Coulomb's Law

4. If two charges are repelled by a force that is now 36 times stronger, by what factor did their separation distance change?

$$\frac{F_2}{F_1} = \frac{\frac{kq_1\,q_2}{(xr)^2}}{\frac{kq_1\,q_2}{(r)^2}} = 36 = \frac{\frac{1}{x^2r^2}}{\frac{1}{(r)^2}} = \frac{1}{x^2}$$

$$36x^2 = 1$$

x = 1/6, so r_2 = 1/6 of r_1

5. If the force was only made twice as strong by increasing each sphere's charge by a factor of 4, how much farther apart are the spherres?

$$\frac{F_2}{F_1} = \frac{\frac{k4q_1\,4q_2}{(xr)^2}}{\frac{kq_1\,q_2}{(r)^2}} = 2 = \frac{\frac{16}{x^2r^2}}{\frac{1}{(r)^2}} = \frac{16}{x^2}$$

$$2x^2 = 16$$

$$x = \sqrt{8} = 2\sqrt{2}$$

$$r_2 = 2\sqrt{2}\, r_1$$

Concentration

6. We add 30.0 L of water to a tank of sugar solution, changing the concentration from 2.0 to 1.8 moles/L. How much water was originally in the tank?

$$C_1V_1 = C_2V_2$$

$$2.0\,V_1 = 1.8(V_1+30.0)$$

$$2.0\,V_1 = 1.8\,V_1+54$$

$$V_1 = 270\ \text{L}$$

7. **Given:** $2Al + 3Cl_2 \rightarrow 2\ AlCl_3$

When 80 grams of aluminum is reacted with excess chlorine gas, how many individual ions of Al^{+3} are produced? Chloride ions?

80 g Al (mol/27 g) = 2.96 moles Al

There is a 1:1 ratio(2:2) between Al and $AlCl_3$, therefore there are 2.96 moles $AlCl_3$.

2.96 moles $AlCl_3$ X 6.02 X 10^{23} ions of Al^{+3}/mole $AlCl_3$= 1.78×10^{25} ions

For every mole of Al^{+3} there are 3 chloride ions, so = 3 X 1.78×10^{25} = 5.34 X 10^{25}

8. A compound has the following mass % composition:

C 54.55%

H 9.09%

O 36.36 %

Find the simplest molecular formula this compound can have.

1) Take 100.0 g of each. Convert to moles and you get:

C 4.45…moles

H : 9 moles

O: 2.2725 moles

2) Divide by the smallest number:
C2H4O (make sure you can make a dot structure for the formula. It works.

Genetics

9. a) Show a Punnett square for Rr X rr, where R = round and r is the allelic gene for wrinkled peas.

	R	r
r	Rr	rr
r	Rr	rr

b) What is the genotypic ratio for this crosss?
1: 1 of Rr to rr
c) Phenotypic ratio?
1:1 of round to wrinkled
d) how many chromosomes carry the genes Rr?
2
e) How many R genes are found in 5 pea egg cells?
5eggs (1 R/egg) = 5 R genes

10. **Fill in the blanks:**

In protein synthesis, amino acids are linked to form larger molecules known as_peptides(proteins)The number of bases that code for an amino acid is _3__. Unlike tRNA, mRNA plays a role in both translation and __transcription_. In order for mRNA to form on DNA, the double helix must first _____be_opened up by enzymes____

Pretest 3.6 (STE PART only)

Physics

We interrupt this ST technology-stuff for a little physics review.

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   b) What two assumptions regarding applied force and friction did you make in solving the above problem?

2. A large book is placed on a table used for drawing. The table is tilted at 60.0 ° and the book's weight is 45N. What is the effective force that causes the book to slide down the table. First draw what is being described.

3. After the LHA prom at the Chateau Vaudreuil, which is really neither a chateau nor a castle, Joe refuses to drive fast. He doesn't want to crash because he enjoys kissing his girl friend and solving physics problems and knows very well that he won't enjoy sitting in a coffin under flowers. To convince his friends to be cautious, he urges them to calculate the ratio of kinetic energy of his 2000 kg vehicle moving at 120 km/h versus his vehicle moving at 80 km/h.

   a) Calculate that ratio.

   b) In case of a collision, how much more force of impact will his car have at 120 km/h compared to 80 km/h? How much more braking distance will a faster car need?

Coulomb's Law

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5. If the force was only made twice as strong by increasing each sphere's charge by a factor of 4, how much farther apart are the spherres?

Concentration

6. We add 30.0 L of water to a tank of sugar solution, changing the concentration from 2.0 to 1.8 moles/L. How much water was originally in the tank?

Stoichiometry

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