Physics 1130 | Test I | Name SOLUTION
Physics For Poets | June 6, 2002 | Mail # _____

Instructions: This test is divided into two parts. Part A is entitled short answer questions where you are to pick the best word, phrase or choice of answers which best answers or, in some cases, defines the statement. Part B is entitled longer answer questions. Make your answers clear and concise. If you need more room turn over the test paper and continue on the back, but please write "over" on the test. For problems, it is the procedure that will be checked, not only the answer so please try to make it clear. Be sure to include units in answering problems (such as we've done in class). Point weighing is indicated in parentheses. So for this, the first test of the summer poets' course, Good Luck!

A. Short Answer Questions

1. (6) Choose from the physical quantities which we have discussed - length, area, volume, time, mass, speed, acceleration, and force to answer the following:

length a) "How long" something is can be given by its ?.

volume b) The amount of space occupied by an object is a 3 dimensional measurement called ?.

mass c) The quantity of "matter" contained by an object is called ?.

acceleration d) A measure of how much an object speeds up is called ?.

speed e) A measure of how fast an object is moving is given by the ?.

force f) Weight is a ?.

2. (12) Choose from the list of physical quantities listed in question 1 to identify the quantities listed below taken from various problems.

length a) 6.3 ft

force b) 5.2 N

force c) 2.92 kg m/s^2

time d) 3.62 s

volume e) 9.8 ft^3

acceleration f) 2.75 (ft/sec)/sec

area g) 4.7 square meters

acceleration h) 3.62 m/sec^2

mass i) 3.9 slug

force j) 2.7 lb

area k) 2.77 ft^2

time l) 2.25 H

3. (3) Write the following in Scientific Notation.

9.02×10^{-6} kg a) .00000902 kg

2.51×10^{10} mi b) 25,100,000,000 miles

5.002×10^{-1} c) .5002 m

4. (3) Write the following in ordinary notation.

.000321 m a) 3.21×10^{-4} m

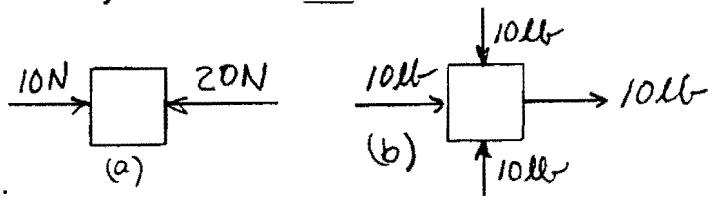
52,100. m b) 5.21×10^{4} m

.7002 kg c) 7.002×10^{-1} kg

$4m^3 = \left(\frac{4m^3}{1}\right)\left(\frac{1{,}000{,}000\,cm^3}{1m^3}\right) =$

4 / 4,000,000 5. (2) A box measuring 2 m by 0.5 m by 4 m contains ? m^3 and also contains ? cm^3.

10N ← (a) / 20lb → (b) 6. (2) Find the net force for each of the following:



1000 7. (2) There are ? m in 1 km.

5280ft 8. (3) At an average speed of 88 ft/s, how far will a motorist travel in 1 min (60 sec)? $d = vt = \left(88\frac{ft}{s}\right)(60s) = 5280$

8 H 9. (3) The distance from Minneapolis to Chicago is about 400 mi. How long will this trip take if you average 50 mi/H? $d = vt$ $(400mi) = \left(50\frac{mi}{H}\right)t$ $t = \frac{400mi}{50mi/H} = 8H$

176ft 10. (2) If you're traveling at 60 mi/H and look to the side for 2 s, how many feet are traveled during this inattentive period? (Note: 88 ft/s = 60 mi /H) $d = \left(88\frac{ft}{s}\right)(2s) = 176ft$

432 in^2 / 3456 in^3 11. (2) Fill in the blanks: (a) ? in^2 = 3 ft^2 (b) ? in^3 = 2 ft^3

$12in = 1ft$ $144in^2 = 1ft^2$ $1728in^3 = 1ft^3$ $3ft^2 = \left(\frac{3ft^2}{1}\right)\left(\frac{144in^2}{1ft^2}\right) = 432in^2$ $2ft^3 = \left(\frac{2ft^3}{1}\right)\left(\frac{1728in^3}{1ft^3}\right) = 3456in^3$

5,000,000 12. (2) Note the prefix Mega "M": 5 Ms = ? s.

12 m/s or $12\,m/s^2$ 13. (2) An object speeds up from rest to 60 m/s in 5 s. Its acceleration is ?. (Be sure to include units.) $a = \frac{\text{change in vel}}{\text{time}} = \frac{60m/s}{5s} = 12\frac{m/s}{s}$

1,000,000,000 or 10^9 14. (2) There are ? cubic mm in one cubic m. $(1000mm)^3 = (1m)^3$

50mi 15. (3) If 1.6 km = 1 mi, how far away in mi is 80 km? $80km = \left(\frac{80km}{1}\right)\left(\frac{1mi}{1.6km}\right) = 50mi$

$540 16. (3) If cotton cost \$5 per square ft, the cost of a 2 yd wide by 6 yd long piece of cotton is ?. (Note: 3 ft = 1 yd.) Area = 6ft × 18ft = 108 ft^2 Cost = ($5/$ft^2$)(108 ft^2) = $540

5 ft^2 17. (2) 720 square in equals ? square ft. $720in^2 = \left(\frac{720in^2}{1}\right)\left(\frac{1ft^2}{144in^2}\right) = 5ft^2$

Galileo 18. (1 ½) A famous scientist known as the "father" of experimental science is ?.

Galileo 19. (1 ½) A famous scientist who underwent a trial to give up his "heretical" beliefs contained in a book that he wrote which contained results of his astronomical findings from his newly invented telescope.

Newton 20. (1 ½) A famous scientist who is given credit for discovery and development of the calculus, but who was a very paranoid, non-sociable individual.

Newton 21. (1 ½) A famous scientist who discovered the "Universal" Law of Gravitation and formalized three major laws of motion.

0 ← zero! 22. (1) If an object is moving at a constant speed (with no increase or decrease in that speed, then the acceleration of that object is ?.

B. Longer Answer Questions

1. (2) If an object travels at constant speed, does it also have a constant velocity? Explain.

Not necessarily. It must also be going in a straight line if its velocity is constant — namely, it's direction cannot change!

2. (4) A car travels a distance of 100 ft in 5 sec. $v = \frac{\text{dist}}{\text{Time}} = \frac{100\,ft}{5\,s} = 20\,ft/s$

(a) Find the average speed of the car: ↑

(b) Find the distance traveled:

(i) After 1 sec: 20 ft

(ii) After 2 sec: 40 ft

(iii) After 4 sec: 80 ft

3. (4) A dragster speeds up from rest to 100 ft/s in 5 s. $a = \frac{\text{change in velocity}}{\text{Time}} = \frac{100\,ft/s}{5\,s} = 20\,ft/s/s$

(a) What is the acceleration of the car? $20\,\frac{ft/s}{s}$

(b) Find the speed of the car

(i) After 1 s: 20 ft/s

(ii) After 2 s: 40 ft/s

(iii) After 4 s: 80 ft/s

4. (3) Discuss the significance of Galileo's famous "Tower of Pisa" experiment. How did the results of this experiment compare to the ideas of the Greeks?

The Greeks believed that heavier objects would accelerate greater than lighter objects.
Galileo tested this idea different masses off the Tower of Pisa. He found that for masses (where friction is negligible), all accelerated at the same rate — i.e., $32\,\frac{ft/s}{s}$ or $9.8\,\frac{m/s}{s}$.

5. (6) Convert 30 mi/H to cm/s. A string of conversion factors or a fraction is quite satisfactory; you need not multiply out the numbers to get full credit.

NOTE: 12 in = 1 ft
60 sec = 1 min
60 min = 1 H
5280 ft = 1 mi
1 mi = 1.6 km
2.54 cm = 1 in

$$30\,\frac{mi}{H} = \left(\frac{30\,mi}{1\,H}\right)\left(\frac{5280\,ft}{1\,mi}\right)\left(\frac{12\,in}{1\,ft}\right)\left(\frac{2.54\,cm}{1\,in}\right)\left(\frac{1\,H}{60\,min}\right)\left(\frac{1\,min}{60\,s}\right)$$

$$= 1341\,\frac{cm}{s}$$

192
-32
160
-32
128
-32
96
-32
64
-32
32
-32
0

6. An object is given an initial velocity of 192 ft per sec straight up into the air at t = 0 sec. Use the acceleration due to gravity as 32 ft/sec^2 or 9.8 m/sec^2. Neglect air friction.

(a) Find its velocity at the following times:

$v = 0$

7s $v = 32$ ft/s — 4s 8

8s $v = 64$ ft/s — 4s 0

9s $v = 96$ ft/s — 3s 0

10s $v = 128$ ft/s — 2s 0

11s $v = 160$ ft/s — t = 1s 0

12s $v = 192$ ft/s — t = 0 0

160 ft/s ↑ (1)(i) t = 1 sec

96 ft/s ↑ (1)(ii) t = 3 sec

32 ft/s ↑ (1)(iii) t = 5 sec

32 ft/s ↓ (1)(iv) t = 7 sec

(b)(1) How long does the object take to return to the thrower's hand?

12 s

(c)(2) How high did the object go? $d = \frac{1}{2} a t^2 = \frac{1}{2}\left(32 \frac{ft}{s^2}\right)(6s)(6s) = 576\ ft$

(d)(1) The acceleration at the top of the path is what? 32 ft/s^2

7. (4) State Newton's First Law and give an example of each case mentioned in the first law.

If the net force acting on an object is zero, then

(1) an object at rest remains at rest — BOOK SITTING ON TABLE

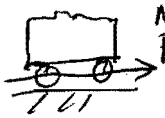
(2) An object in motion continues in motion (i) at constant speed (ii) in a straight line — HOCKEY PUCK ON ICE → CONSTANT SPEED (FRICTION ~~FORCE~~ NEGLIGIBLE)

8. (4) State and give two examples of Newton's Second Law

If there is a net force acting on an object,

Then Net Force = mass × acceleration

Q $F = ma$



Thrust Force on rocket ship; it accelerates!

9. (4) (a) An object accelerates from rest to 20 m/s in 5 s. Find the acceleration.

$$a = \frac{20\ m/s}{5\ s} = \boxed{4\ \frac{m}{s^2}}$$

(b) If the mass of the object is 100 kg, find the net force necessary to give it the acceleration of part (a)

$$F = ma$$

$$F = (100\ kg)\left(4\ \frac{m}{s^2}\right) = \boxed{400\ N}$$