Physics 1130 Test II NAME SOLUTION TO
Physics for Poets June 13, 2002 Mail # _____ PRACTICE TEST

Instructions: This test has the same format as before. Part A consists of short answer questions where you are to pick the best work, phrase, or choice of answer which best answers or, in some cases, defines the statement. Part B consist of longer answer questions. Make your answers clear and concise. For Part A please use the rules for precision or significant figures if *data* has been measured (indicated by the underline of the precision digit.) If you need more room turn over the test paper and continue on the back but please indicate on front. For problems it is the procedure that will be checked, not only the answer, so please try to make it clear. So for this, the 2nd poets' test of the term, Good Luck!

Declaration: I elect to do a (term paper, lab project). Please circle.

1. (10) REVIEW QUESTION PLUS: Choose from the physical quantities which we have discussed - length, area, volume, time, mass, force, velocity (or speed), acceleration, period - to identify the following quantities taken from problems.

length a) 25.2 m
area b) 21.3 square ft
speed c) 7.48 m/sec
time d) 4.92 sec
period (or Time) e) 5 sec/cycle
volume f) 3.74 m^3
mass g) 1.43 kg
acceleration h) 1.85 m/sec^2
Mass i) 3.54 lb sec^2/ft = slug
speed j) 5.3 in/sec
area l) 23.4 m^2
mass m) 23.2 g
force n) 78.3 N
time o) 33.2 H
force p) 7.1 kg m/sec^2 = N

2. (4) For the following two length measurements indicate the precision and number of significant figures for each, add them, and multiply them using the rules strictly. (Include units for parts "c" and "d.")

	Precision	No. of significant figures
a) 43.24 cm	±.01 cm or to the nearest hundredth cm	4
b) 210.4 cm	±.1 cm or to the nearest tenth cm	4

c) sum of a) + b) equals 253.6 cm

d) product of a) times b) equals 9098 cm^2

.804 s/cycle 3. (2) A pendulum was observed to take 65.0 sec to make 80.8 complete swings (or cycles). It's period is ? $T = \frac{65.0s}{80.8 \text{ cycles}} = .804 s/\text{cycle}$

167 lb 4. (1 ½) A person weighing 250 lb here on earth goes to planet X having a radius three times that of the earth and a mass six times as large. The person will weigh ? on the surface of that planet. $F_{NEW} = \frac{(1)(6)}{3*3}(250lb)$

1920 lb 5. (1 ½) A person weighing 120 lb here on earth goes to planet Y having a radius one-half that of the earth and a mass 4 times greater than the earth. The person will weigh ? on the surface of that planet. $F_{NEW} = \frac{(1)(4)}{(.5)(.5)}(120lb)$

Both sources of the forces were the earth 6. (1) The amazing generalization that was made by Newton as he was studying the force holding the moon in orbit and the force that caused the apple to drop from the tree was ?.

13.3 lb 7. (2) A person 4000 mi *from the center* of the earth weighs 120 lb. How much will she weigh at a distance of 12000 mi *from the center*? $F_{NEW} = \frac{(1)(1)}{(3)(3)}(120lb)$

No 8. (3) For question 7, does the mass of the woman change at the distance of 12000 mi *from the center*? What is the acceleration due to gravity at this height? (Note: It is not 32 ft/s/s.)

3.6 ft/s^2

$W = mg$ m is constant

Hence $W \propto g$

$\frac{1}{9}W$ means $\frac{1}{9}g = \frac{1}{9}(32 ft/s^2) = 3.6 ft/s^2$

(a) 9. (1 ½) A lunar month is about 28 days. If the moon were closer to the earth than what it presently is, the lunar month would be (a) less than 28 days, (b) unchanged, (c) greater than 28 days. (Choose one.)

(b) 10. (1) When a comet is **farther from** the sun, its speed (a) is faster (b) is slower or (c) does not change from what it is when it is closer from the sun. (Choose one.)

centripetal 11. (1 ½) An object is being twirled at the end of a string in a circular motion at constant speed. The force exerted by the string on the object directed inward toward the center of the circle is called the ? force.

No 12. (1) Does the force described in question 11 cause the object to speed up or slow down? (Yes, No).

Yes 13. (2) Does an acceleration exist for the motion of question 11? (Yes, No). Explain your answer: A force is necessary to change the direction!

14. (1 ½) Describe the "reaction" force to the force that is described in question 11? The force exerted by the object on the string. (This force keeps the string tight thereby providing "Tension")

lubrication (oil or air) streamlining roller bearings 15. (3) Three ways of reducing friction are ?, ?, and ?.

weight 16. (1) The force exerted by the earth on our body is called ?.

(b) 17. (2) For a projectile, its horizontal motion is (a) accelerated, (b) at constant speed, (c) non existent. (Neglect air friction.)

(a) 18. (2) For a projectile, its vertical motion is (a) accelerated, (b) at constant speed, (c) non existent. (Neglect air friction.)

19. (2) Explain why the following statement is technically incorrect: "As a car rounds a corner, there is a force which pushes the person to the side". The person continues in a straight line while the car turns out from under the person! There is NO force!

15 kg 20. (1 ½) The mass of a 147 N object is ? $w = mg$ or $m = \frac{w}{g} = \frac{147\ kg\ m/s^2}{9.8\ m/s^2} = 15\ kg$

22 kg 21. (1 ½) The mass of a 22 kg object is ?.

6 slugs 21. (1 ½) The mass of a 192 lb object is ? $w = mg$ or $m = \frac{w}{g} = \frac{192\ lb}{32\ ft/s^2} = 6\ \frac{lb\ s^2}{ft} = 6\ slugs$

Ptolemy 22. (1) The name of a person who first determined an elaborate model that was based on an earth-centered Universe with planets traveling around circles whose centers were in circular orbits about the earth. This model was so powerful (albeit complicated) that it could predict solar eclipses!

Copernicus 23. (1) A less complicated model placed the sun at the center of our solar system and maintained equal, if not better, prediction capabilities as the model of question #22 was devised by ?.

Tycho Brahe 24. (1) A Danish astronomer who spent his whole life taking remarkably accurate data of the planets that later was used by Kepler was ?.

ellipse 25. (1) A circular hoop is turned at a slight angle relative to an observer. The observer sees a geometric curve called ?.

the range 26. (1) The horizontal distance traveled by a projectile is called ?.

B. Longer Answer Questions:

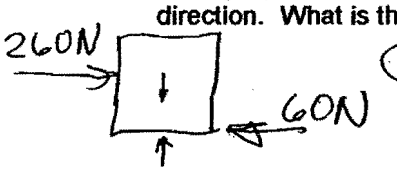
1. (4) A net force of 50 N accelerates an object at 2 m/sec^2. $F = ma$

(a) What is the mass of the object? $m = \frac{F}{a} = \frac{50\ kg\cdot m/s^2}{2\ m/s^2} = 25\ kg$

(b) What is the weight of the object?

$W = mg = (25 kg)(9.8\ m/s^2) = 245 N$

2. (a)(3) (Parts b and c are REVIEW.) A woman exerts a force of 260 N to a full grocery cart whose mass is 100 kg. (This is one strong woman!) There is a frictional force of 60 N acting in the opposite direction. What is the acceleration of the cart? (Hint: First find the *Net Force*.)



NET FORCE "F" = 200N →

$F = ma$ or $a = \frac{F}{m} = \frac{200\ kg\cdot m/s^2}{100\ kg} = 2\ m/s^2$

(b)(2) How fast will the cart be moving after 5 sec if it starts from rest? $= t$

$v = at$

$v = (2\ m/s^2)(5\ s) = 10\ m/s$

(c)(2) How far will the cart move after 5 sec again starting from rest?

$d = \frac{1}{2}at^2$

$d = (.5)(2\ m/s^2)(5s)(5s) = 25\ m$

3. (4) Distinguish between true weightlessness and apparent weightlessness.

4. (4) State all three of Kepler's Laws and use diagrams where helpful.

5. (5) (a) Explain what is meant by a "direct" proportion. (b) How can one prove clearly and convincingly that two physical quantities are indeed directly proportional? (c) What is a "constant of proportionality?"

6. (4) (a) Explain what is meant by the term "terminal velocity." (b) Upon what *other* physical quantities does terminal velocity depend?

7. A plane is flying horizontally at 4000 ft above the surface of the earth and drops a care package. Neglect air friction and assume a flat earth.

(a) (3) Explain the horizontal and then the vertical motion of the care package relative to the plane.

(b) (2 bonus points!) Calculate the time that it takes for the care package to strike the ground.

The horizontal velocity is constant, but the initial vertical velocity is 0. Hence, $d = \frac{1}{2}at^2 = (.5)(32\,ft/s^2)t^2 = 4000ft$

$$t^2 = \frac{4000ft}{(.5)(32\,ft/s^2)} = 250s^2 \Rightarrow t = 15.8s$$

8. (4) State Newton's Third Law and make up two specific examples of its use. Include diagrams and show and explain all forces.

9. Define or briefly describe the following terms:

(2) centrifugal force

(2) the projection angle for maximum range (a) without friction and (b) with friction included

(2) centrifuge

(2) instrumental errors (when writing up a laboratory)

(2) inherent errors (when writing up a laboratory)

(2) Simulated gravity