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 that we have discussed - length, area, volume, time, mass, speed, acceleration, and force to answer the following:

   - **area**
     - a) The amount of surface is a 2 dimensional measurement called ___.
     - b) The amount of space occupied by an object is a three-dimensional measurement called ___.

   - **force**
     - c) A push or a pull is called ___.
     - d) A measure of the quantity of matter contained by an object is called ___.

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

   - **time**
     - a) 6.3 H
     - b) 5.2 N
     - c) 2.92 ft²
     - d) 3.62 sec

   - **length**
     - e) 9.8 ft

   - **acceleration**
     - f) 2.75 (m/sec)/sec
     - g) 4.7 m³
     - h) 3.63 lb

   - **mass**
     - i) 3.9 slug
     - j) 2.7 m/sec²
     - k) 2.77 kg
     - l) 2.25 ft/sec

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

   - a) $2.7 \times 10^{-6}$ kg
   - b) $2.1 \times 10^6$ miles
   - c) $5.2 \times 10^{-1}$ m

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

   - a) $3.21 \times 10^{-6}$ m
   - b) $5.2 \times 10^6$ m
   - c) $7.002 \times 10^{-3}$ kg
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1. A box measuring 1.5 ft by 2.0 ft by 3.0 ft contains __ ft³ or __ in³.
   
2. There are __ mm in 1 m.
   
3. At an average speed of 60 mi/h, how far will a motorist travel in 8.0 hours?
   
4. One gram (or 1 g) is equal to __ milligram (mg).
   
5. There are __ cubic cm in one cubic m.
   
6. The word "free fall" describes the motion of something acted upon by __ but in the absence of __.
   
7. A brilliant scientist, credited with one of the first measurements of the acceleration due to gravity and with the beginning of "experimental science", was named __.

8. The distance from Hamline to downtown Minneapolis is 7.0 mi. How long will this trip take if you average 28 mi/hr?
   
9. If 1.6 km = 1 mile, how far away in miles is 2000 m?
   
10. How does "velocity" differ from "speed"? Provide an example for an object that moves at constant speed but has a changing velocity.
2. (5) What is the significance of Galileo's famous "Tower of Pisa" experiment and how did it contradict the Greek's "common-sense" idea?

Galileo's Tower of Pisa demonstrated that different masses fell off the top at the tower at the same rate. (The masses were large enough that air friction was not significant.)

The Greeks believed that more massive objects would speed up more than less massive objects.

3. (6) Convert 300 mm/s to m/H. A string of conversion factors or a fraction is quite satisfactory; you need not multiply out the numbers to get full credit.

\[ 300 \text{ mm/s} = \frac{300 \text{ cm}}{1 \text{ s}} \times \frac{1 \text{ m}}{100 \text{ cm}} \times \frac{1 \text{ km}}{1000 \text{ m}} \times \frac{1 \text{ mi}}{1.6 \text{ km}} = 0.675 \text{ mi/H} \]

OR \[ 300 \text{ mm/s} = \frac{300 \text{ cm}}{1 \text{ s}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ H}}{5280 \text{ ft}} \times \frac{1 \text{ mi}}{1 \text{ H}} = 0.671 \text{ mi/H} \]

4. An object is given an initial velocity of 49.9 m per sec straight up into the air at \( t = 0 \) sec. The acceleration due to gravity is 32 ft/sec\(^2\) or 9.8 m/sec\(^2\). Neglect air friction.

(a) Find its velocity at the following times:

\[ v = \frac{49.9 \text{ m/s}}{t} \]

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>Velocity (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>-7.8</td>
</tr>
<tr>
<td>3.0</td>
<td>-9.8</td>
</tr>
<tr>
<td>5.0</td>
<td>-11.8</td>
</tr>
<tr>
<td>7.0</td>
<td>-13.8</td>
</tr>
</tbody>
</table>

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

\[ t = \frac{19.6 \text{ m/s}}{9.8 \text{ m/s}^2} = 2 \text{ sec} \]

(c) How high did the object go?

\[ d = \frac{1}{2} a t^2 = \frac{1}{2} (9.8 \text{ m/s}^2)(5^2) = 122.5 \text{ m} \]

(d) The acceleration at the top of the path is what?

\[ a = 9.8 \text{ m/s}^2 \text{ downward} \]
5. An object moves at constant speed traveling a distance of 90 m in 5.0 seconds.
(a) (2) Find its speed.
\[ \text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{90 \, \text{m}}{5.0 \, \text{s}} = 18 \, \text{m/s} \]

(b) (2 ½) Find the distance traveled after
(i) \( t = 1.0 \, \text{sec} \) \( \frac{18 \, \text{m}}{36 \, \text{m}} \)
(ii) \( t = 2.0 \, \text{sec} \) \( \frac{36 \, \text{m}}{72 \, \text{m}} \)
(iii) \( t = 3.0 \, \text{sec} \) \( \frac{54 \, \text{m}}{90 \, \text{m}} \)
(iv) \( t = 4.0 \, \text{sec} \) \( \frac{72 \, \text{m}}{90 \, \text{m}} \)
(v) \( t = 5.0 \, \text{sec} \) \( \frac{90 \, \text{m}}{90 \, \text{m}} \)

(c) (1 ½) Make a sketch of the approximate position of the object at the above times.

6. An object speeds up at the constant rate of 5.0 \( \text{ft/s/s} \) starting from rest. Find:

(a) (3) how fast is the object moving
(i) after \( t = 1.0 \, \text{s} \): \( 5.0 \, \text{ft/s} \)
(ii) after \( t = 2.0 \, \text{s} \): \( 10.0 \, \text{ft/s} \)
(iii) after \( t = 3.0 \, \text{s} \): \( 15.0 \, \text{ft/s} \)

(b) (3) the distance that the object has traveled
(i) after \( t = 1.0 \, \text{s} \): \( \frac{2 \times 5.0^2}{2} = 2.5 \, \text{ft} \)
(ii) after \( t = 2.0 \, \text{s} \): \( \frac{2 \times 5.0^2}{2} = 10.0 \, \text{ft} \)
(iii) after \( t = 3.0 \, \text{s} \): \( \frac{2 \times 5.0^2}{2} = 15.0 \, \text{ft} \)

(c) (2) Make an approximate sketch of the position of the object at the above times.

7. (4) Define a "direct proportion" and give a specific example of two physical (measurable) quantities that are directly proportional to each other. [There are 3 equivalent definitions you just need one!]

Two physical quantities are directly proportional to each other if:
- when you double one, you also double the other.
- Triple one, triple the other.
- Etc.

Examples: \underline{Weight \& Mass} are directly proportional. You double the gravity, you also double the force of gravitation on the object.

Secret No. ___