

AP PHYSICS C MECHANICS (ENGINEERING PHYSICS): SUMMER ASSIGNMENT

UNIT 1: INTRODUCTION AND MATHEMATICAL CONCEPTS AND PHYSICS

*Do all of your homework (summer assignment) on a separate sheet of paper. Write the problem and then solve. Show all work, include units, box all final answers!*

Conversions:

Convert the following length measurements to its equivalent in meters:

1. 35 mm
2. 456 cm
3. 15000mm
4. 1.1 cm
5. 76.2 pm
6. 2.1 km
7. 0.123 Mm

Convert each of the following mass measurements to its equivalent in kilograms:

8. 147 g
9. 11  $\mu\text{g}$
10. 7.23 Mg
11. 478 mg

Convert each of the following measurements into meters:

12. 42.3 cm
13. 6.2 pm
14. 21 km
15. 0.023 mm
16. 214  $\mu\text{m}$
17. 570 nm
18. Rank the following mass measurements from smallest to largest: 11.6 mg, 1021  $\mu\text{g}$ , 0.000006 kg, 0.31 mg.
19. A balance is an instrument used to measure
20. A meter stick is an instrument used to measure
21. A graduated cylinder is an instrument used to measure
22. A beaker is an instrument used to measure
23. A flask is an instrument used to measure
24. 75 mm = \_\_\_\_\_ m
25. 450 cm = \_\_\_\_\_mm
26. 250 km = \_\_\_\_\_cm
27. 1500 $\mu\text{g}$  = \_\_\_\_\_g
28. 346 ms = \_\_\_\_\_ s
29. 543 mg = \_\_\_\_\_ kg
30. 200 ml = \_\_\_\_\_ L
31. 6.5 cm = \_\_\_\_\_mm
32. 8 m = \_\_\_\_\_mm
33. 14 cm = \_\_\_\_\_m
34. 6.8 km = \_\_\_\_\_ m
35. 12 cm = \_\_\_\_\_m
36. .4 g = \_\_\_\_\_cg
37. 13 m = \_\_\_\_\_km
38. Convert 450 m/s to m/h
39. Convert 85 cm/min to m/s
40. The density of water is 1 g/cm<sup>3</sup>. What is this value in kilograms per cubic centimeter?
41. What is the volume of a box having the following dimensions? 6 m x 8 m x 80 cm
42. A liter of water is equal to how many mL?
43. Convert 200 cm<sup>3</sup> to mL
44. What is the area of a board 2 m long and 90 cm wide?
45. Convert the speed of light 3.0 x 10<sup>8</sup> m/s to km/day

46. The Concorde was the fastest airliner used for commercial service and could cruise at 1450 mi/hr (about two times the speed of sound, in other words, Mach 2). (a) What is the cruise speed of the Concorde in mi/s? (b) What is the cruise speed of the Concorde in m/s? (1 mile = 1.609 km)
47. What is the cruise speed of the Concorde in m/s? (1 mile = 1.609 km)
48. Compute the number of seconds in a day (24 hr), and in a year (365 days)
49. The speed limit on a highway in Lower Slobberia was given as 150,000 furlongs per fortnight. How many miles per hour is this? (One furlong is 1/8 mile, and a fortnight is 14 days.).

**Math Review**

50. Solve the following problem for x:  $\frac{ay}{x} = \frac{cb}{s}$

51. Solve the following problem for x:  $y = mx + b$   
52. Solve for b:  $y = mx + b$

Solve the following equations for v:

53.  $d = vt$   
54.  $t = d/v$   
55.  $a = v^2/2d$   
56.  $v/a = b/c$   
57.  $v^2 - v_0^2/2g = a$

Solve the following equations for E:

58.  $f = E/s$   
59.  $m = 2E/v^2$   
60.  $E/c^2 = m$   
61.  $E - U = K$

**Solve each of these equations for a:**

62. Solve the equation  $v^2 = v_i^2 + 2ad$   
63.  $v = v_i + at$   
64.  $v^2 = v_i^2 + 2ay$   
65.  $v = \sqrt{2as}$   
66. Solve the equation  $T = 2\pi \sqrt{\frac{l}{g}}$  for l  
67. Solve the above equation for g.  
68.  $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$  solve for y  
69. Solve the following equation for r  $q/m = 2V/B^2r^2$   
70.  $E = \frac{1}{2}mv^2$  solve for m  
71. Solve the above equation for v  
72.  $E = mgh$ , solve for h  
73.  $P = fd/t$ , solve for d  
74.  $E = hf - W$ , solve for W  
75. Solve the above equation for h  
76.  $r/n^2 = h^2/4\pi^2 kmq^2$ , solve for q

**Scientific notation:**

Express the following numbers in scientific notation

77. 5000000000000000000000 m  
78. 0.000000000000000000166 m  
79. 2033000000 m  
80. 0.0000001030 m

### Adding, Subtracting, Multiplying, and Dividing with Exponents

81.  $(8 \times 10^2) \div (2 \times 10^{-4})$
82.  $(6 \times 10^2) \div (2 \times 10^8)$
83.  $(4 \times 10^{-7}) \times (2 \times 10^9)$
84.  $(3 \times 10^7) \times (2 \times 10^4)$
85.  $4.9 \times 10^3 - 2.0 \times 10^2$
86.  $2.0 \times 10^3 + 3.2 \times 10^4$
87.  $3.0 \times 10^3 + 4.2 \times 10^3$
88.  $[(3 \times 10^4)(4 \times 10^4)] \div 6 \times 10^4$
89.  $6 \times 10^8 \div 2 \times 10^{-4}$
90.  $6 \times 10^8 - 4 \times 10^8$
91.  $8 \times 10^6 \div 2 \times 10^{-2}$
92.  $8 \times 10^6 \div 2 \times 10^{-2}$
93.  $(2 \times 10^4)(4 \times 10^8)$
94.  $(3 \times 10^4)(2 \times 10^6)$
95.  $(6 \times 10^{-4})(5 \times 10^{-8})$
96.  $(2.5 \times 10^{-7})(2.5 \times 10^{16})$
97.  $(3 \times 10^6)(2 \times 10^3)$
98.  $(2 \times 10^{-5})(4 \times 10^9)$
99.  $(4 \times 10^3)(5 \times 10^{11})$
100.  $4 \times 10^8 + 3 \times 10^8$

### Significant Figures

State the number of significant digits in each measurement

101. 2804 m
102. 2.84 m
103. 0.0029 m
104. 0.003068m
105.  $4.6 \times 10^5$  m
106.  $4.06 \times 10^3$  m
107. 75 m
108. 75.00 mm
109. 0.007060 kg
110.  $1.87 \times 10^6$  ml
111.  $1.008 \times 10^8$  m
112.  $1.20 \times 10^{-4}$  m
113. 248 m
114. 64.01 m
115. 0.00003 m
116. 80.001 m
117.  $2.40 \times 10^6$  kg
118.  $6 \times 10^8$  kg
119.  $4.07 \times 10^{16}$  m
120. Add 6.201 cm, 7.4 cm, 0.68 cm, and 12.0 cm
121. Subtract 8.264 g from 10.8 g
122. Subtract 0.4168 m from 475 m
123. Multiply 131 cm x 2.3 cm
124. Multiply 3.2145 km x 4.23 km
125. Divide 20.2 cm by 7.41 s
126. Divide 3.1416 m by 12.4 s

Add, subtract, multiply, or divide as indicated and state the answer with the correct number of significant digits

127.  $16.2 \text{ m} + 5.008 \text{ m} + 13.48 \text{ m}$
128.  $5.006 \text{ m} + 12.0077 \text{ m} + 8.0084 \text{ m}$
129.  $78.05 \text{ cm}^2 - 32.046 \text{ cm}^2$

130.  $15.07 \text{ kg} - 12.0 \text{ kg}$   
 131.  $(6.2 \times 10^{18} \text{ m})(4.7 \times 10^{-10} \text{ m})$   
 132.  $(5.6 \times 10^{-7} \text{ m}) / (2.8 \times 10^{-12} \text{ s})$   
 133.  $(8.1 \times 10^{-4} \text{ m})(1.6 \times 10^{-3} \text{ m}^3)$   
 134.  $(6.5 \times 10^5 \text{ kg}) / (3.4 \times 10^3 \text{ m}^3)$

### GRAPHING

135. For the following data table. (a) Draw a graph  
 (b) Calculate the slope. (c) Calculate the y-intercept.  
 (d) Write the equation of the graph.  
 (e) Describe the shape of the graph.

x	y
0	2
1	5
2	8
3	11

136. For the following data table. (a) Draw a graph  
 (b) Calculate the slope. (c) Calculate the y-intercept.  
 (d) Write the equation of the graph.  
 (e) Describe the shape of the graph.

Force (N)	Elongation (cm)
0	0.0
1	0.7
2	1.5
3	2.1
4	2.7
5	3.5

137. During a laboratory experiment, a student measured the mass of  $10.0 \text{ cm}^3$  of water. The student then measured the mass of  $20.0 \text{ cm}^3$  of water. In this way the data in the table was collected. (a) Plot the values given in the table and draw the curve that best fits all points (b) Describe the resulting curve. (c) According to the graph, what is the relationship between the volume of the water and the mass of the water?

Volume ( $\text{cm}^3$ )	Mass (g)
10.0	10.0
20.0	20.1
30.0	29.8
40.0	40.2
50.0	50.3

138. During a science demonstration, Ms. Plageman placed a 1 kg mass on a horizontal table that was nearly frictionless. The instructor then applied various horizontal forces to the mass and measured the rate at which the mass gained speed (was accelerated) for each force applied. The results of the experiment are shown in the table.  
 (a) Plot the values given in the table and draw the curve that best fits all points.  
 (b) all points. (b) According to the graph, what is the relationship between the force applied to a mass and the rate at which it gains speed?

Force (N)	Acceleration ( $\text{m/s}^2$ )
5.0	4.9
10.0	9.8
15.0	15.2
20.0	20.1
25.0	25.0
30.0	29.9

139. Ms. Plageman decided to change the procedure for the last experiment. The mass was varied while the force was kept constant. The rate at which each mass gained speed was then recorded. The results are shown in the graph. (a) Plot the values and draw the curve that best fits all points. (b) Describe the resulting curve (c) According to the graph, what is the relationship between mass and the acceleration produced by a constant force?

Mass (kg)	Acceleration ( $\text{m/s}^2$ )
1.0	12.0
2.0	5.9
3.0	4.1
4.0	3.0
5.0	2.5
6.0	2.0

### Percent error:

140. Working in the laboratory, a student find the density of a piece of pure aluminum to be  $2.85 \text{ g/cm}^3$ . The accepted value for the density of aluminum is  $2.699 \text{ g/cm}^3$ . What is the student's percent error?

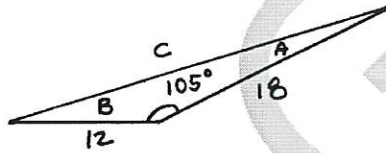
141. A student experimentally determines the specific heat of water to be  $4.29 \text{ J/g} \times \text{C}^\circ$ . He then looks up the specific heat of water on a reference table and finds that is  $4.18 \text{ J/g} \times \text{C}^\circ$ . What is his percent error?
142. A student takes an object with an accepted mass of  $200.00$  grams and masses it on his own balance. He records the mass of the object as  $196.5 \text{ g}$ . What is his percent error?

**Trigonometry:**

Find the size of the angles associated with each trigonometric function below.

143.  $\sin \theta = 0.500$   
 144.  $\sin \theta = 0.985$   
 145.  $\cos \theta = 0.707$   
 146.  $\sin \theta = 0.707$   
 147.  $\tan \theta = 1.00$   
 148.  $\tan \theta = 0.364$   
 149.  $\tan \theta = 2.050$   
 150.  $\cos \theta = 0.866$

151. One angle of a right triangle is  $20.0^\circ$ . The length of the hypotenuse is  $6.00 \text{ cm}$ . Calculate the lengths of the other two sides.
152. One angle of a right triangle is  $35^\circ$ . The length of the side opposite the angle is  $14 \text{ cm}$ . Calculate the length of the side adjacent to the angle.
153. One angle of a right triangle is  $26^\circ$ . The hypotenuse is  $11 \text{ cm}$ . Calculate the lengths of the other two sides.
154. One angle of a right triangle is  $50.0^\circ$ . The length of the side opposite the  $50.0^\circ$  angle is  $8.50 \text{ cm}$ . Calculate the length of the adjacent side and the hypotenuse.
155. Find length  $c$ , angle  $B$ , side  $b$



156. Find side  $a$ , angle  $A$ , and angle  $B$

