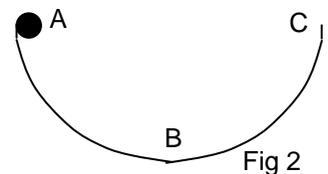
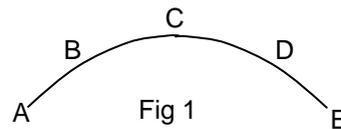


One Hundred and Fifty Questions

1. What two entities comprise a vector?
2. What do you do with any vector that is not on either the x or y axis?
3. How are velocity and speed different?
4. What is the slope of the distance time graph?
5. What is acceleration?
6. What is the area under the velocity time graph?
7. What is the slope of the velocity time graph?
8. What is the y intercept of the velocity time graph?
9. What is the area under the acceleration time graph?
10. What is the horizontal acceleration of projectiles?
11. What dimension controls time in falling body and projectile motion problems?
12. When two objects are launched horizontally
13. What equation describes the distance that a dropped object falls t seconds after it started moving?
14. What equation describes the distance that a horizontally launched projectile falls t seconds after it started moving?
15. What equation describes the speed of a dropped object t seconds after it started moving?
16. What equation describes the speed in the x direction of a projectile t seconds after it started moving?
17. What equation describes the speed in the y direction of a projectile t seconds after it started moving?
18. A projectile follows the path in Fig. 1.
At what points does it have the same speed?
19. A projectile follows the path in Fig. 1.
At what point is its horizontal speed the greatest?
20. A projectile follows the path in Fig. 1.
What is the direction of acceleration at points A, B, C, D, and E? (Zero, up, down, right, left?)
21. A projectile follows the path in Fig. 1. What is the direction of the vertical speed at point C?
22. What is implied when an object is not accelerating in the x direction?
23. What is implied when an object is not accelerating in the y direction?
24. When is sum of force (net force) zero, and when is it non-zero?
25. What force is always present, and what is its equation?
26. How is sum of force (net force) depicted in a FBD?
27. When is a normal force present, what is its direction?
28. What is the component of F_g down a slope?
29. What is the general equation for motion down a slope and how does it change if the object is going up the slope?
30. In circular motion, how is tangential velocity calculated?
31. What is centripetal acceleration and force?
32. What is the direction of acceleration of the object, in Fig. 2,
at points A, B, C? (Zero, up, down, right, left?)
33. What is the direction of velocity of the object, in Fig. 2,
at points A, B, C? (Zero, up, down, right, left?)
34. How is F_c represented in a FBD?
35. Mathematically what does F_c represent and how is F_c calculated?
36. Which vectors are positive and negative in circular motion?
37. What are some possibilities that can create F_c ?
38. What is the work done on an object moving in a circle? Why?
39. If you double the mass of one planet, triple the mass of another, and move them twice as far apart, what happens to the force of attraction between them?
40. What is the derived equation for the acceleration of gravity in terms of m and r^2 ?
41. How can total momentum be calculated?
42. What is the difference between elastic and inelastic collisions? State the relevant equations for each.
43. What is impulse, and how does it relate to both momentum and force?
44. What is a key requirement in order for work to be done?
45. Work is the area under which curve?
46. What is work energy theorem and what is its significance?



47. What is conservation of energy and what is its significance?
48. What is the energy equation if you see a height difference between two points in the problem?
49. What is the energy equation if you see a particle accelerated perpendicular to two charged plates, or the problem states that the particle is accelerated through a potential difference?
50. What is Kinetic Energy lost and how is it calculated?
51. What is the energy equation for the change in temperature if it results from a loss in KE?
52. What is the energy equation if a force (friction) through a distance results in heat and thus a change in temperature?
53. What is the relationship that describes the rate that work is done, or that energy is used?
54. In a pendulum or spring, what are the displacement, velocity, U_s and K at the equilibrium position?
55. In a pendulum or spring, what are the displacement, velocity, U_s , and K at maximum displacement?
56. What do the period of pendulums and springs each depend on?
57. What is temperature?
58. What is internal energy?
59. What is heat?
60. What is meant by the terms system and environment?
61. What are the two forms of the ideal gas law?
62. What is latent heat, and why does the temperature stay the same when state changes occur?
63. What is specific heat capacity?
64. What is the first law of thermodynamics?
65. What is an isothermal process, and what is its impact on the first law of thermodynamics?
66. What is an adiabatic process, and what is its impact on the first law of thermodynamics?
67. What is the area under any pV curve?
68. Under what conditions is work positive and negative?
69. Under what conditions is heat positive and negative?
70. What is the net work done by an entire process?
71. What is the second law of thermodynamics?
72. Describe the relationship between Q_H , Q_C , and W in a heat engine?
73. What is the difference between a heat engine and a refrigerator?
74. How can you tell when an engine is a Carnot Engine?
75. Under what conditions does entropy increase?
76. What are 2 key differences between electric force and gravitational force?
77. In electricity, what takes the place of m and g ?
78. If you have two charges, and you double one charge and triple the other, and move them twice as far apart, what happens to the force of attraction / repulsion between them?
79. What is the derived equation for the electric field in terms of q and r^2 ?
80. What is the difference between q and Q ?
81. What do the terms: potential difference, electric potential, potential energy, and electric potential energy mean?
82. What is the potential energy of a charge in an electric field?
83. Why is the potential energy of a capacitor half of the electric energy in the preceding problem?
84. What are three ways to increase the capacitance of a capacitor?
85. What forces charges to move?
86. What indicates the ease with which charges can be moved?
87. What do batteries and generators produce?
88. What is the actual movement of charges, and how is it measured?
89. What causes resistance, and how does a wires composition, length, thickness, and temperature effect resistance?
90. What are the relationships between voltage, current, resistance, and power?
91. What stays the same in a series circuit, and what adds?
92. What stays the same in a parallel circuit and what adds?
93. What is the path of a charged particle in a magnetic field, and how is the force on the creating the path calculated?
94. What is the work done on a charged particle by the magnetic field? Why?
95. What is the force on a current carrying wire?
96. What is electromagnetic induction?
97. What is needed for electromagnetic induction to occur?

98. What is the difference between *emf* and voltage? State the relevant equation.
99. How does the right hand rule work in electromagnetic induction?
100. What is the difference between a motor and a generator?
101. What are the differences and similarities between transverse and longitudinal waves? Give examples of each type.
102. What is the relationship between speed, frequency, and wavelength?
103. What is the relationship between energy, frequency, and wavelength in any wave?
104. How are wavelength and amplitude measured on a sinusoidal wave?
105. What are the wavelengths for strings, open tubes, and closed tubes?
106. What cause an electromagnetic wave, and what makes the wave propagate indefinitely even in a vacuum?
107. What is the order of the electromagnetic spectrum, including the order of the color composing visible light?
108. What is the difference between reflection, refraction, and diffraction?
109. What is the law of reflection?
110. What is Snell's Law?
111. What is Fermat's Principle?
112. What happens at the critical angle?
113. When light goes from a less to a more dense medium what changes and how does it change?
114. What doesn't change (speed, frequency, or wavelength), when light moves from one medium to another?
115. What conditions are necessary to change the reflected rays phase by 180° ?
116. What shapes are converging in lenses and in mirrors?
117. What shapes are diverging in lenses and in mirrors?
118. What are the two rules for ray tracing in lenses that work all the time?
119. What are the three rules needed for mirrors, since not all three work every time?
120. What do you do if your forward ray traces are diverging?
121. When are f , s_o , s_i , h_o , h_i , and M positive.
122. When are f , s_o , s_i , h_o , h_i , and M negative.
123. What is the difference between a real and virtual image, and how is each formed?
124. What is Huygen's Principle?
125. Describe Young's experiment and state its significance.
126. What does the pattern look like in a Young Double Slit diffraction pattern?
127. What does the pattern look like in a single slit diffraction pattern?
128. What was Thompson's discovery? Describe the apparatus and experiment.
129. What was Milikan's discovery? Describe the apparatus and experiment.
130. What was Rutherford's discovery? Describe the apparatus and experiment.
131. What is the Bohr Model of the atom?
132. What is the photon energy equation?
133. What is mass energy equivalence?
134. What does light absorption involve?
135. What does light emission involve?
136. What is ionization energy and how does it compare to the work function?
137. What is the photoelectric effect?
138. What is the difference between atomic number and mass number?
139. How do you find the number of neutrons in an atom?
140. What is an isotope?
141. What are binding energy, total binding energy, and average binding energy?
142. What is the strong force?
143. What causes radioactivity?
144. What is transmutation?
145. What are the three types of radiation? Describe each including its composition and origin.
146. What is half-life, and how does 512 g of a radioactive substance change thru 10 half lives?
147. What is the difference between fission and fusion?
148. How hard will you study for the AP Exam?
149. What will your score be on the test?
150. Are you in control or just along for the ride?

What if?

A projectile is launched horizontally:

$$x = v_{ox}t \quad v_{ox} = v_x = v_o \quad y = \frac{1}{2}gt^2$$

A mass is spun vertically on a string:

$$F_c = F_{Ttop} + F_g \quad F_c = F_{Tbottom} - F_g$$

An object moves horizontal, on a flat surface:

$$F_c = \text{force causing circular motion}$$

A mass is spun horizontally on a string, and it is hanging down:

$$F_T^2 = F_c^2 + F_g^2$$

You see a height difference:

$$mgh_{top} = \frac{1}{2}mv_{bottom}^2$$

The term energy or work (units J) are used with time (units s):

$$P = \frac{W}{t}$$

Kinetic Energy is lost:

$$K_{lost} = K_{initial} - K_{final}$$

Kinetic Energy lost turns into heat:

$$K_{lost} = mc\Delta T$$

The process is isothermal (slow), so temperature is not changed:

$$\Delta U = 0 \quad \Delta U = Q - W \quad W = Q$$

The process is adiabatic (fast), so heat is not added:

$$Q = 0 \quad \Delta U = Q - W \quad W = \Delta U$$

You see a charge particle moving perpendicular to two charged plates:

$$qV_{start} = \frac{1}{2}mv_{end}^2$$

A charged particle is accelerated by an electric field:

$$qV_{start} = \frac{1}{2}mv_{end}^2$$

A charged particle enters a magnetic field:

$$m\frac{v^2}{r} = qvB$$

Tips and Strategies

- Try energy first.
Energy is directionless and has the advantage of working throughout all five major subject areas. It is the universal thread tying it all together. You must be flexible and adaptable here.
- Try force second.
If an object is not moving in one or more dimensions then force may be the answer. What are the forces acting on the object and in what direction are they acting. Are they canceling or resulting in acceleration?
If you see a vector at an angle, split it into the **x** and **y** directions. Analyze each direction independently.
What is the object doing in the relevant direction?
Is it standing still or does it have constant velocity, then $\sum F = 0$
There must be equal & opposite forces in the direction (horizontal or vertical) that you are analyzing.
Is it accelerating, then $\sum F = ma$
So the forces in the direction (horizontal or vertical) that you are analyzing are out of balance.
- Last try kinematics.

When you get stuck: Think

- Conservation of energy
- Work Energy Theorem
- Power