Introduction, Dimensions, and Units
Concept Questions

Question 1.

How many of the following statements do you consider to be true:

1. Mathematics is the language of physics and can be a source of factual knowledge.

2. The laws of physics are exact, definitive, and absolute.

3. The body of knowledge in physics is a collection of many directly perceived facts.

4. Aptitude is as (if not more) important than personal effort in learning physics.

5. The methods of science are situation specific.

a) 1
b) 2
c) 3
d) 4
e) 5
f) 0

Answer f. While the answer may not be entirely clear-cut, most physicists would agree that none of the above statements are true.

Question 2.

Which of the following statements constitutes a scientific hypothesis?

1. Atoms are the smallest particles of matter that exist.
2. Space is permeated with a substance that is undetectable.

Answer 1. A scientific hypothesis must be verifiable (in other words, one must be able to devise a test to see if the hypothesis is correct). Choice 1, while incorrect (smaller particles than atoms have been detected), is testable. Choice 2 can never be verified because the statement says that the substance in question is undetectable.

Question 3. What are the dimensions of energy?

1. $[L][T^{-2}]$

2. $[M][L][T^{-2}]$

3. $[M][L^2][T^{-2}]$

4. $[M][L^2][T^{-3}]$

5. None of the above.

Answer 3. The dimensions of energy are equal to the dimensions of force times distance. The dimensions of force are $[M][L][T^{-2}]$ and the dimensions of distance are $[L]$. Therefore the dimensions of energy are $[M][L^2][T^{-2}]$.

Question 4. What are the SI units of power?

1.m/s^2

2.$kg\text{-}m/s^2$

3.$kg\text{-}m^2/s^2$

4.$kg\text{-}m^2/s^3$

5.None of the above

Answer 4. The SI units of power are equal to the SI units of energy divided by the SI units of time, s. The SI units of energy are the product of the SI units of force, $kg\text{-}m/s^2$, and the SI units of distance, m. Therefore the SI units of energy are $kg\text{-}m^2/s^2$. Hence the SI units of power are $kg\text{-}m^2/s^3$.