

Assignment Preview

[Close this window](#)**Course:** Physics 401, Summer 1 2004**Dates:**

Available: Tue May 18 2004 08:49 AM EDT

Due: Thu May 27 2004 11:59 PM EDT

Homework 1

1. CJ6 1.P.004. [294486] Bicyclists in the Tour de France reach speeds of 30.5 miles per hour (mi/h) on flat sections of the road.

(a) What is this speed in kilometers per hour?

[1] km/h

(b) What is this speed in meters per second?

[1] m/s

2. CJ6 1.P.007. [239365] The following are dimensions of various physical parameters that will be discussed later on in the text. Here [L], [T], and [M] denote, respectively, dimensions of length, time, and mass.

	Dimension		Dimension
Distance (x)	[L]	Acceleration (a)	[L]/[T] ²
Time (t)	[T]	Force (F)	[M][L]/[T] ²
Mass (m)	[M]	Energy (E)	[M][L] ² /[T] ²
Speed (v)	[L]/[T]		

Which of the following equations are dimensionally correct?

(a) $F = ma$

yes

no [1]

(b) $x = 10 at^2$

yes

no [1]

(c) $E = 1/2 max$

yes

no [1]

(d) $E = max$

yes

no [1]

(e) $t = \sqrt{Fx/m}$

yes

no [1]

3. CJ6 1.P.008. [239366] The variables x , v , and a have the dimensions of $[L]$, $[L]/[T]$, and $[L]/[T]^2$, respectively. These variables are related by an equation that has the form $v^n = 2ax$, where n is an integer constant (1, 2, 3, etc.) without dimensions. What must be the value of n , so that both sides of the equation have the same dimensions?

[1]

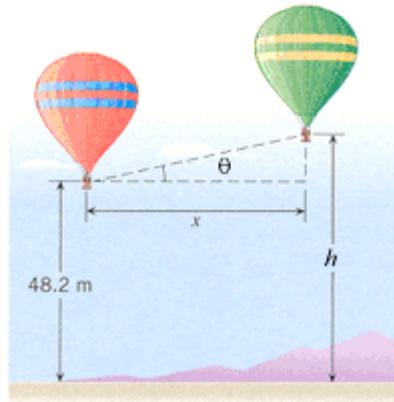
Explain your reasoning.

[1]

4. CJ6 1.P.014. [294419] The two hot air balloons in the drawing are 48.2 and $h = 58.0$ m above the ground. A person in the left balloon observes that the right balloon is $\theta = 12.0^\circ$ above the horizontal. What is the horizontal distance x between the two balloons?

[1]

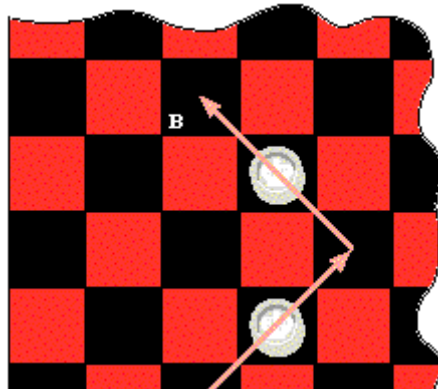
m

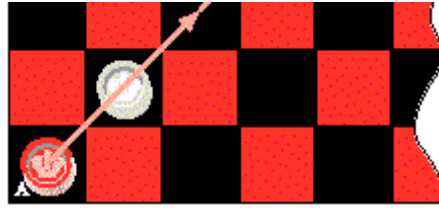


5. CJ6 1.P.024. [239375] The drawing shows a triple jump on a checkerboard, starting at the center of square A and ending on the center of square B. Each side of a square measures 4.5 cm. What is the magnitude of the displacement of the colored checker during the triple jump?

[1]

cm





6. CJ6 1.P.022. [294495] (a) Two workers are trying to move a heavy crate. One pushes on the crate with a force **A**, which has a magnitude of **440** newtons and is directed due west. The other pushes with a force **B**, which has a magnitude of **355** newtons and is directed due north. What are the magnitude and direction of the resultant force **A + B** applied to the crate? (Express the direction relative to due west.)

[1] N
 [1] ° [1] ---Select--- of west

(b) Suppose that the second worker applies a force **-B** instead of **B**. What then are the magnitude and direction of the resultant force **A - B** applied to the crate?

[1] N
 [1] ° [1] ---Select--- of west

7. CJ6 2.P.004. [294468] The Space Shuttle travels at a speed of about 7.8×10^3 m/s. The blink of an astronaut's eye lasts about **120** ms. How many football fields (length = 91.4 m) does the Shuttle cover in the blink of an eye?

[1] football fields

8. CJ6 2.P.012. [294416] For a standard production car, the highest road-tested acceleration ever reported occurred in 1993, when a Ford RS200 Evolution went from zero to 26.8 m/s (60 mi/h) in 3.275 s. Find the magnitude of the car's acceleration.

[1] m/s²

Repeat your calculation for another car which goes from zero to 60 mi/h in **4.385** s.

[1] m/s²

9. CJ6 2.P.014. [239420] NASA has developed Deep-Space 1 (DS-1), a spacecraft that is scheduled to rendezvous with the asteroid named 1992 KD (which orbits the sun millions of miles from the earth). The propulsion system of DS-1 works by ejecting high-speed argon ions out the rear of the engine. The engine slowly increases the velocity of DS-1 by about 19.0 m/s per day.

(a) How much time (in days) will it take to increase the velocity of DS-1 by **13800** m/s?

[1] days

(b) What is the acceleration of DS-1 (in m/s²)?

[1] m/s²

10. CJ6 2.P.020. [294453] Review Conceptual Example 7 as background for this problem. A car is traveling to the left, which is the negative direction. The direction of travel remains the same throughout this problem. The car's initial speed is 27.0 m/s, and during a **5.2** s interval, it changes to the following final speeds. In each case, find the acceleration (magnitude and algebraic sign) and whether or not the car is decelerating.

(a) The final speed is **28.1** m/s.

- [1] m/s² and the car is [1]
- (b) The final speed is 25.3 m/s.
- [1] m/s² and the car is [1]

11. CJ6 2.P.030. [239429] A speedboat starts from rest and accelerates at +2.01 m/s² for 7.15 s. At the end of this time, the boat continues for an additional 6.10 s with an acceleration of +0.518 m/s². Following this, the boat accelerates at -1.49 m/s² for 8.45 s.

(a) What is the velocity of the boat at $t = 21.7$ s?

[2] m/s

(b) Find the total displacement of the boat.

[2] m

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