101-0021

The standard kilogram is a platinum-iridium cylinder 39 mm in height and 19.5 mm in radius. What is the density of the material?

21 g/cm**3
1.0 g/cm**3
13 g/cm**3
11 g/cm**3
19 g/cm**3

$\text{density} = \frac{\text{mass}}{\text{volume}} \Rightarrow \rho = \frac{m}{V} = \frac{m}{\pi R^2 h} = \frac{1}{\pi (39\times10^{-3})^2 \, 19.5\times10^{-3}}$

$= 21464 \frac{kg}{m^3}$

$\rho = 21464 \frac{kg}{m^3} \times \left(\frac{10^3 g}{1 kg}\right) \times \frac{1 m^3}{10^{-6} cm^3} = \boxed{21.5 \; g/cm^3}$

Fig (1) shows the velocity (Vx) of a particle moving along x axis as a function of time (t). What is the acceleration of the particle at t= 2.0 s?

-4 m/s**2
+4 m/s**2
-1 m/s**2
+1 m/s**2
0 m/s**2

$v = at + v_0 \Rightarrow a = \frac{v - v_0}{t} = \frac{0-8}{2} = \boxed{-4 \; m/s^2}$

The speed of sound in air is about 350 m/s. Express this speed in miles per hour (mi/h).
(1 mile = 1.61 km)

783 mi/h
350 mi/h
564 mi/h
980 mi/h
0 mi/h

$350 \frac{m}{s} = 350 \frac{m}{s} \times \left(\frac{1 km}{1000 m}\right) \times \left(\frac{1 mi}{1.61 km}\right) \times \left(\frac{3600 s}{1 h}\right)$

$= \boxed{782.6 \; mi/h}$

A particle moving along the x axis has a position given by
x =(24 t - 2 t**3) meters,
where t is measured in seconds. How far is the particle from the origin (x=0) when the particle stops momentarily?

32 m
23 m
40 m
17 m
98 m

particle stops $\Rightarrow v = 0 = \frac{dx}{dt} = 24 - 6t^2 \Rightarrow t = 2s$

$x = 24 \times 2 - 2 \times (2)^3 = 48 - 16 = \boxed{32 m}$

In 2.0 seconds, a particle moving with constant acceleration along the x axis goes from x=10 m to x=50 m. The velocity at the end of this time interval is 10 m/s. What is the acceleration of the particle?

-10 m/s**2
+15 m/s**2
-15 m/s**2
+20 m/s**2
-20 m/s**2

$x - x_0 = vt - \frac{1}{2} a t^2$

$50 - 10 = 10 \times 2 - \frac{1}{2} a \times 4 \Rightarrow \boxed{a = -10 \; m/s^2}$

A stone is thrown downward from height (h) above the ground with an initial speed of 10 m/s. It strikes the ground 3.0 seconds later. Determine h.

74 m
44 m
14 m
90 m
60 m

$y - y_0 = v_0 t - \frac{1}{2} g t^2$

$h = -10 \times 3 - 4.9 \times 9 = -74.1 \; m$