PHYS101-052
MAJOR 1 EXAM

1. A nucleus of volume 3.4 x 10^3 fm^3 and mass of 1.0x 10^2 u has a density of:
   (1 fm = 10^{-15} m, 1 u = 1.7 x 10^{-27} kg)
   A) 5.0×10^{16} kg/m^3
   B) 1.0×10^3 kg/m^3
   C) 3.4×10^{14} kg/m^3
   D) 12×10^3 kg/m^3
   E) 3.6×10^{13} kg/m^3

2. An object starts from rest at the origin and moves along the x axis with a constant acceleration of 4 m/s^2. Its average velocity as it goes from x = 2 m to x = 18 m is:
   A) 1 m/s
   B) 2 m/s
   C) 6 m/s
   D) 5 m/s
   E) 8 m/s

3. Two cars are 150 km apart and traveling toward each other. One car is moving at 60. km/h and the other is moving at 40. km/h. In how many hours will they meet?
   A) 2.5 h
   B) 2.0 h
   C) 1.9 h
   D) 1.5 h
   E) 1.2 h

4. The coordinate of a particle in meters is given by $x(t) = 16t - 3.0t^3$, where the time t is in seconds. The particle is momentarily at rest at time=
   A) 0.75 s
   B) 1.3 s
   C) 5.3 s
   D) 7.3 s
   E) 9.3 s

5. A stone and a ball are thrown vertically upward with different initial speeds: 20 m/s for the stone and 10 m/s for the ball. If the maximum height reached by the ball is H then the maximum height reached by the stone is:
   A) 4 H
   B) 2 H
   C) H
   D) H/2
   E) H/4

Answer key

1. A
2. E
3. D
4. B
5. A

PHYS101-051
MAJOR 1 EXAM
<u>Test Code</u>: 000

1. The mass of 1.0 cm^3 of gold is 19.3 g. What is the mass of a solid cube of gold having a side of 0.70 cm?
   A) 0.11 kg
   B) 9.1×10^{-2} kg
   C) 3.6×10^{-3} kg
   D) 6.6×10^{-3} kg
   E) 21 kg

2. A helicopter at height h (m) from the surface of the sea is descending at a CONSTANT SPEED v (m/s). The time it takes to reach the surface of the sea can be found from:
   A) $h = \frac{1}{2} g t^2$
   B) $-h = -v t$
   C) $-h = \frac{1}{2} g t^2$
   D) $h = v t - \frac{1}{2} g t^2$
   E) $-h = -v t - \frac{1}{2} g t^2$

3. A particle starts from rest at t = 0 s. Its acceleration as a function of time is shown in Fig. 1. What is its speed at the end of the 6.0 s?

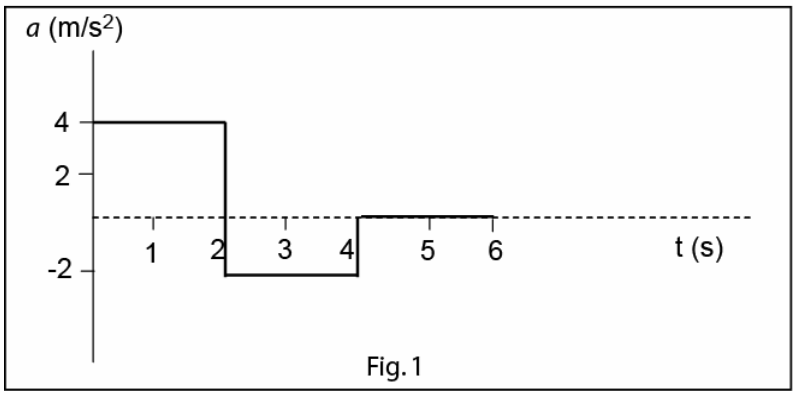

Fig. 1

A) 0 m/s
B) 4.0 m/s
C) 12 m/s
D) 2.0 m/s
E) -12 m/s

4. The position of a particle x(t) as a function of time (t) is described by the equation: $x(t) = 2.0 + 3.0\,t - t^3$, where x is in m and t is in s. What is the maximum positive position of the particle on the x axis?
A) 4.0 m
B) 2.0 m
C) 3.0 m
D) 1.0 m
E) 5.0 m

5. A stone is thrown vertically downward from a building with an initial speed of 2.0 m/s. It reaches the ground after 5.0 s. What is the height of the building?
A) 60 m
B) 130 m
C) 180 m
D) 120 m
E) 140 m

PHYS101 First Major Exam Formula Sheet

$$y = cx^n; \qquad \frac{dy}{dx} = cnx^{n-1}$$

Motion in One Dimension

$$v = \frac{dx}{dt}; \qquad a = \frac{dv}{dt}; \qquad v_{avg} = \frac{\Delta x}{\Delta t}; \qquad a_{avg} = \frac{\Delta v}{\Delta t}$$

Motion with Constant Acceleration

$v = v_o + at$		$x - x_o = v_o t + \frac{1}{2}at^2$
$v^2 = v_o^2 + 2a(x - x_o)$	$x - x_o = \frac{1}{2}(v + v_o)t$	$x - x_o = vt - \frac{1}{2}at^2$

Free Fall

$$a = -g; \qquad g = 9.8 m/s^2$$

Vectors

$$\vec{a} \cdot \vec{b} = ab\cos\phi \qquad \left|\vec{a} \times \vec{b}\right| = ab\sin\phi$$

Motion in Two Dimensions

$$\vec{v} = \frac{d\vec{r}}{dt}; \qquad \vec{a} = \frac{d\vec{v}}{dt}$$

$$\vec{r} - \vec{r}_o = \vec{v}_o t + \frac{1}{2}\vec{a}t^2; \qquad \vec{v} = \vec{v}_o + \vec{a}t$$

Projectile Motion

$a_x = 0$	$x - x_o = v_o \cos\theta_o t$
$a_y = -g$ = -9.80 m/s^2	$y - y_o = v_o \sin\theta_o t - \frac{1}{2}gt^2$
$H = v_o^2 \sin^2\theta_o / 2g$	$R = v_o^2 \sin 2\theta_o / g$

Uniform Circular Motion

$$a = \frac{v^2}{r}$$

$$T = \frac{2\pi r}{v}$$

Relative Motion

$$\vec{v}_{PA} = \vec{v}_{PB} + \vec{v}_{BA}$$

$\vec{v}_{AB}$ = velocity of A relative to B $= -\vec{v}_{BA}$

Newton's Second Law

$$\sum \vec{F} = m\vec{a} \quad \Rightarrow \quad \sum F_x = \mathrm{ma}_x; \quad \sum F_y = \mathrm{ma}_y$$

Friction

$$f_{s,\max} = \mu_s N; \quad f_k = \mu_k N$$