Q1.
An aluminum cylinder of density 2.70 g/cm^3, a radius of 2.30 cm, and a height of 1.40 m has the mass of:

A) 6.28 kg
B) 45.1 kg
C) 13.8 kg
D) 8.50 kg
E) 25.0 kg

Q2.
A stone is thrown vertically downward from the top of a 40 m tall building with an initial speed of 1.0 m/s. After 2.0 s the stone will have traveled a distance of

A) 22 m
B) 38 m
C) 40 m
D) 25 m
E) 15 m

Q3.
A particle starts from the origin at t = 0 and moves along the positive x-axis. A graph of the velocity of the particle as a function of time is show in Fig 1. The average velocity of the particle between t = 0.0 s and 5.0 s is:

Fig#

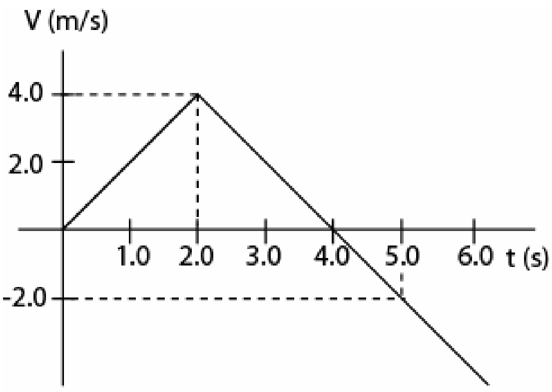

Figure 1

A) 1.4 m/s
B) 1.0 m/s
C) -2.0 m/s
D) 3.5 m/s
E) 0 m/s

Q4.

At a traffic light, a truck traveling at 10 m/s passes a car as it starts from rest. The truck travels at a constant velocity and the car accelerates at 4.0 m/s^2. How much time does the car take to catch up with the truck?

A) 5.0 s
B) 2.0 s
C) 15 s
D) 20 s
E) 25 s

Q5.
The coordinate of a particle in meters is given by $x(t) = 2.0t - 2.0t^2$, where the time *t* is in seconds. The particle is momentarily at rest at time *t* equal to:

A) 0.50 s
B) 0.75 s
C) 2.0 s
D) 1.3 s
E) 4.0 s

Q6.
A vector in the xy plane has a magnitude of 25 m and an *x* component of +12 m and a positive *y* component. The angle it makes with the positive y axis is:

A) 29°
B) 26°
C) 61°
D) 64°
E) 241°

Q7.
If $\vec{A} = (2.0\hat{i} - 3.0\hat{j})m$ and $\vec{B} = (1.0\hat{i} - 2.0\hat{j})m$, then $\vec{A} - 2\vec{B}$ =

A) $(1.0\hat{j})$ m
B) $(-1.0\hat{j})$ m
C) $(4.0\hat{i} - 7.0\hat{j})$ m
D) $(4.0\hat{i} + 1.0\hat{j})$ m
E) $(-4.0\hat{i} + 7.0\hat{j})$ m

Q8.
Two vectors $\vec{A}$ and $\vec{B}$ have magnitudes of 10 m and 15 m respectively. The angle between them is 65°. The component (projection) of $\vec{B}$ along $\vec{A}$ is:

A) 6.3 m

B) 4.2 m
C) 0
D) 9.1 m
E) 7.5 m

Q9.
A train traveling north at 20 m/s turns and then travels south at 20 m/s. The change in its velocity is:

A) 40 m/s south
B) 20 m/s north
C) 20 m/s south
D) 40 m/s north
E) 0 m/s

Q10.
An arrow is shot horizontally from a point *P* toward *X* as shown in Fig 2. It hits at a point *Y*, 0.20 s later. If the speed of the arrow at *P* is v_o= 11 m/s, the distance *PX* is:

Fig#

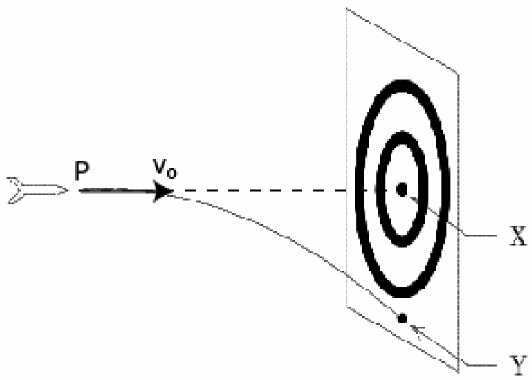

Figure 2

A) 2.2 m
B) 1.0 m
C) 1.8 m
D) 0.1 m
E) 0.5 m

Q11.
A boy wishes to swim across a river from *A* to *B*. He can swim at 1.0 m/s in still water and the river is flowing at 0.50 m/s (Fig 3). At what angle θ should he be heading?

Fig#

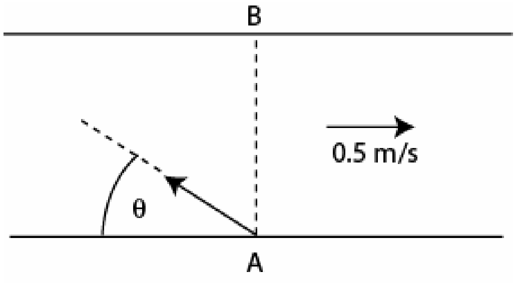

Figure 3

A) 60°
B) 30°
C) 45°
D) 20°
E) 70°

Q12.
A stone is tied to a 0.50 m string and rotated at a constant speed of 2.0 m/s in a vertical circle. Its acceleration at the bottom of the circle is:

A) 8.0 m/s^2, up
B) 9.8m/s^2, down
C) 8.0m/s^2, down
D) 32 m/s^2, up
E) 9.8 m/s^2, up

Q13.
A 4.0 kg block is pushed upward a 30° inclined frictionless plane with a constant horizontal force *F* (Fig 4). If the block moves with a constant speed find the magnitude of the force *F*.

Fig#

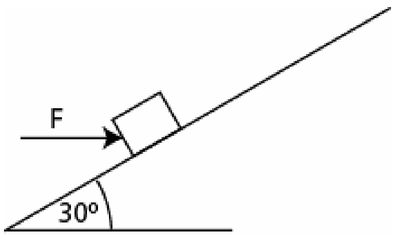

Figure 4

A) 23 N
B) 33 N
C) 40 N
D) 0 N
E) 9.8 N

Q14.
An elevator cab with a total mass of 2000 kg is pulled upward by a cable. If the elevator accelerates at 2.00 m/s^2 upward, find the tension in the cable.

A) 2.36×10^4 N
B) 3.25×10^4 N
C) 1.56×10^4 N
D) 0.00 N
E) 9.80 N

Q15.
To measure your weight, you stand on a spring scale on the floor of an elevator. Among the following situations, select the one that gives the highest reading on the scale:

A) The elevator moves upward with increasing speed.
B) The elevator moves upward with decreasing speed.
C) The elevator remains stationary.
D) The elevator moves downward with increasing speed.
E) The elevator moves downward at constant speed.

Q16.
A 7.0 kg block and a 3.0 kg block are connected by a string as shown in Fig 5. If the pulley is massless and the surface is frictionless, the magnitude of the acceleration of the 3.0 kg block is:

Fig#

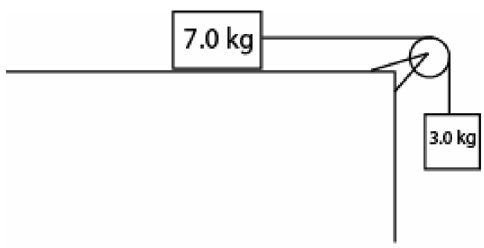

Figure 5

A) 2.9 m/s^2
B) 3.3 m/s^2
C) 4.9 m/s^2
D) 6.7 m/s^2
E) 9.8 m/s^2

Q17.
A box with a weight of 50 N rests on a horizontal surface with μ_s= 0.40. A person pulls horizontally on it with a force of F_2=10 N and it does not move. To start it moving, a second

person pulls vertically upward on the box with a force F_1 (see Fig 6). What is the smallest vertical force (F_1) for which the box starts moving?

Fig#

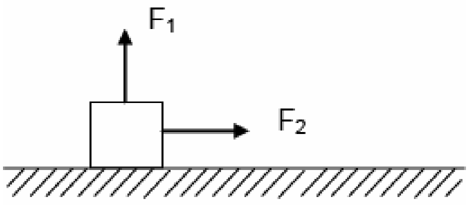

Figure 6

A) 25 N
B) 10 N
C) 14 N
D) 5.0 N
E) 35 N

Q18.
An 8.0 kg block is pushed against a vertical wall by a horizontal force *F* as shown in Fig 7. If the coefficients of friction between the block and the wall are $\mu_s = 0.60$ and $\mu_k = 0.30$ then the minimum value for (*F*) that will prevent the block from slipping is:

Fig#

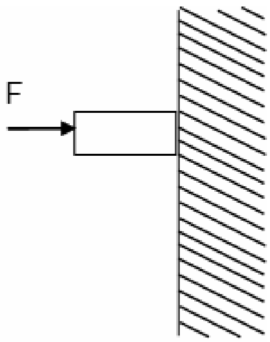

Figure 7

A) 130 N
B) 260 N
C) 78 N
D) 87 N
E) 24 N

Q19.

A 2.0 kg block is released from rest the top of a ramp (point A) as shown in Fig 8. The coefficient of kinetic friction between the block and the inclined surface is 0.20. The speed by which the block hits the bottom (point B) is:

Fig#

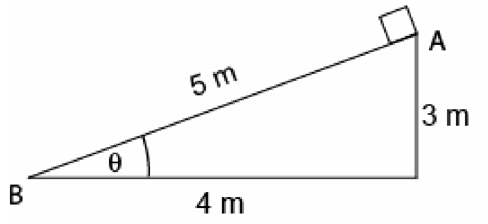

Figure 8

A) 6.6 m/s
B) 11 m/s
C) 0.0 m/s
D) 2.0 m/s
E) 13 m/s

Q20.
A 1000 kg car moves on a level horizontal circular road of radius 50 m. The coefficient of static friction between the tires and the road is 0.50. The maximum speed with which this car can round this curve without slipping is:

A) 16 m/s
B) 4.9 m/s
C) 9.8 m/s
D) 3.0 m/s
E) 12 m/s

Formula Sheet for PHYS101 First Major Exam

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

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

$$a = -\mathrm{g}; \qquad g = 9.80 m/s^2$$

Vector Multiplications

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

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

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

Uniform Circular Motion

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

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

Relative Motion

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

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

Newton's Second Law

$$\sum \vec{F} = m\vec{a} \quad \Rightarrow \quad \sum F_x = \mathrm{m}a_x; \quad \sum F_y = \mathrm{m}a_y$$

Friction

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