Q1.
From the fact that the average density of the Earth is 5.50 g/cm^3 and its mean radius is 6.37 $\times 10^6$ *m*, the mass of the Earth is:

A) 5.95×10^{24} *kg*
B) 3.98×10^{21} *kg*
C) 7.01×10^{17} *kg*
D) 2.80×10^{18} *kg*
E) 5.50×10^{23} *kg*

Q2.
Suppose $A = \frac{B^n}{C^m}$, where *A* has dimensions LT, *B* has dimensions L^2T^{-1}, and *C* has dimensions LT^2. Then the exponents *n* and *m* have the values:

A) $n = 1/5$; $m = -3/5$
B) $n = 2$; $m = 3$
C) $n = 4/5$; $m = -1/5$
D) $n = 1/5$; $m = 3/5$
E) $n = 1/2$; $m = 1/2$

Q3.
A car travels along a straight line at a constant velocity of 18 *m/s* for 2.0 *s* and then accelerate at − 6.0 m/s^2 for a period of 3.0 *s*. The average velocity of the car during the whole 5.0 *s* is:

A) 13 m/s
B) 18 m/s
C) 17 m/s
D) 16 m/s
E) 10 m/s

Q4.
The velocity as a function of time for a particle moving along the *x*-axis is shown in Fig.1. The motion clearly has two different parts: the first part is from $t = 0$ to $t = 2.0$ *s*, and the second part is from $t = 2.0$ *s* to $t = 6.0$ *s*. Which one of the following statements is correct?

Fig#

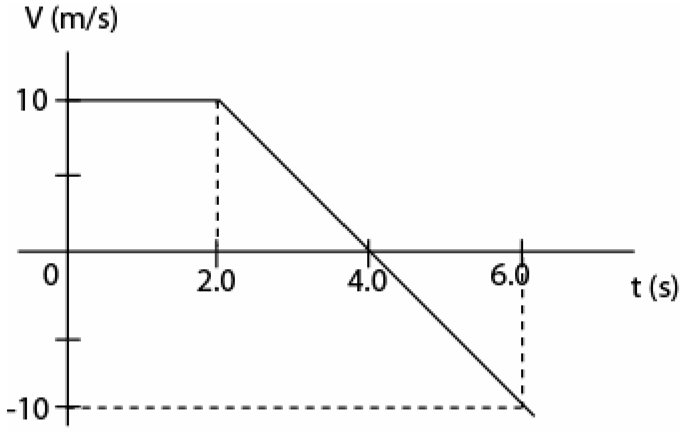

Figure 1

A) At $t = 4.0$ *s* the acceleration is -5.0 m/s^2
B) At $t = 4.0$ *s* the acceleration is zero
C) From t =0 to t=6.0 *s*, the displacement is zero
D) From t =0 to t=6.0 *s*, the displacement is -20 *m*
E) At $t = 1.0$ *s* the acceleration is 10 m/s^2

Q5.
A particle moves along the *x* axis. Its position is given by the equation $x = 2.0 + 3.0t - t^3$ with *x* in meters and *t* in seconds. The average acceleration from $t = 0$ to $t = 2.0$ s is:

A) −6.0 m/s^2
B) 3.0 m/s^2
C) −2.0 m/s^2
D) 4.0 m/s^2
E) −5.0 m/s^2

Q6.
An arrow is shot straight up with an initial speed of 98 *m/s*. If friction is neglected, how high the arrow can reach?

A) 490 *m*
B) 980 *m*
C) 250 *m*
D) 98 *m*
E) 150 *m*

Q7.
$\vec{A}$ and $\vec{B}$ are two perpendicular vectors: $\vec{A} = 3.0\,\hat{i}$ and $\vec{B} = 2.0\,\hat{j}$. The magnitude of $\vec{A} - 2\vec{B}$ is:

A) 5.0.
B) 1.0.
C) 7.0.

D) − 1.0.
E) − 2.0.

Q8.
The angle between $\vec{A} = 3.00\,\hat{i} + 4.00\,\hat{j}$ and the negative *y*-axis is:

A) 143°
B) 61.0°
C) 29.0°
D) 209°
E) 241°

Q9.
Three vectors are given as: $\vec{A} = -3.0\,\hat{i}, \vec{B} = -5.0\,\hat{k}$ and $\vec{C} = 2.0\,\hat{j}$. The value of $\vec{A} \cdot \left(\vec{B} \times \vec{C}\right)$ is:

A) -30
B) 0
C) $30\,\hat{k}$
D) $-30\,\hat{j}$
E) 10

Q10.
The position of a particle is given as $\vec{r} = \left(4.0t - t^2\right)\,\hat{i} + t^3\,\hat{j}$ where *r* is in meters and *t* is in seconds. The particle's acceleration at *t* = 0 *s* is:

A) $\left(-2.0\,\hat{i}\right) m/s^2$
B) $\left(-2.0\,\hat{i} + 6.0\,\hat{j}\right)\ m/s^2$
C) $\left(2.0\,\hat{i} + 3.0\,\hat{j}\right) m/s^2$
D) $\left(6.0\,\hat{j}\right)\ m/s^2$
E) zero

Q11.
A projectile is fired horizontally at a speed of 15 *m/s* from the top of a tower. It lands on the ground at a horizontal distance of 45 *m*. The height of the tower is:

A) 44 *m*
B) 98 *m*
C) 32 *m*
D) 22 *m*
E) 88 *m*

Q12.
If the moon makes a complete circle around the earth in 29 *days* (= 2.5×10^6 *s*) and the distance between the center of earth and the center of the moon is 3.8×10^8 *m*, then the magnitude of centripetal acceleration on the moon is:

A) 2.4×10^{-3} m/s^2
B) 9.8 m/s^2
C) 1.6 m/s^2
D) 1.5×10^2 m/s^2
E) 6.1×10^{-4} m/s^2

Q13.
Two boats *A* and *B* leave seaport at the same time. Boat *A* travels at a speed of 10.0 *m/s* in the +*x* direction and boat *B* heads at an angle of 60.0° with the *x*-axis at a speed of 10.0 *m/s*. The velocity of *A* relative to *B* is

A) $\left(5.00\,\hat{i} - 8.66\,\hat{j}\right) m/s$
B) $\left(20.0\,\hat{i} - 12.7\,\hat{j}\right) m/s$
C) $\left(36.0\,\hat{i} - 12.7\,\hat{j}\right) m/s$
D) $\left(22.3\,\hat{i} - 12.7\,\hat{j}\right) m/s$
E) $\left(5.00\,\hat{i} - 22.3\,\hat{j}\right) m/s$

Q14.
A 500 *kg* car moves in a vertical roller coaster of radius 10.0 *m* at a constant speed of 18.0 *m/s* (see Fig. 2). The magnitude of the force exerted by the track on the car at the bottom of the circle is:

Fig#

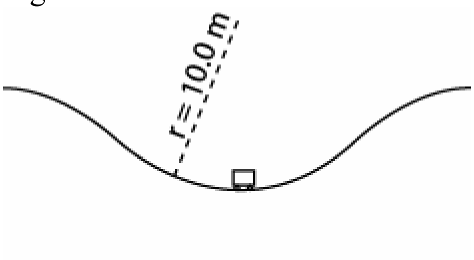

Figure 2

A) 2.11×10^4 *N*
B) 6.80×10^4 *N*
C) 1.13×10^4 *N*
D) 3.47×10^4 *N*
E) 5.19×10^4 *N*

Q15.
Two blocks of masses m_1 = 4.00 *kg* and m_2 = 2.00 *kg* are connected by a string passing over a massless and frictionless pulley and placed on a frictionless horizontal table as shown in Fig. 3. A force of F = 10.0 *N* at an angle of 60.0° with the horizontal is applied to m_1. The magnitude of acceleration of the system is:

Fig#

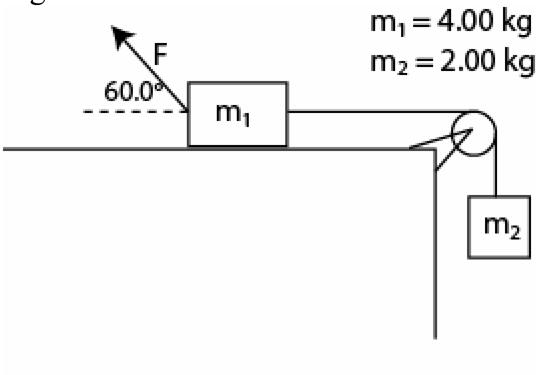

Figure 3

A) 2.43 m/s^2
B) 9.80 m/s^2
C) 3.27 m/s^2
D) 10.84 m/s^2
E) 1.36 m/s^2

Q16.
A car takes a round turn on a flat circular track at a speed of 8.00 *m/s*. The coefficient of static friction between its tires and the track is 0.300. If the car is at the verge of slipping out of the track at this speed, the radius of the track is:

A) 21.8 *m*
B) 60.0 *m*
C) 19.0 *m*
D) 2.57 *m*
E) 7.50 *m*

Q17.
A box of mass *M* is placed on a 30° inclined plane. The box is sliding with an acceleration equals g/2 (g is the free fall acceleration). What is the magnitude of the force of friction between the box and the plane?

A) zero
B) *M*g/2
C) *M*g
D) 0.866 *M*g
E) 2*M*g

Q18.

Two boxes *A* and *B* (m_A = 3.0 *kg* and m_B =1.0 *kg*) are in contact on a horizontal frictionless surface and move along the x-axis (see Fig. 4). A horizontal force $\vec{F} = 10.0\,\hat{i}\ N$ is applied on Box *A*. The net force acting on *A* is $\vec{F}_1$ and on *B* is $\vec{F}_2$. Which one of the following statements is correct?

Fig#

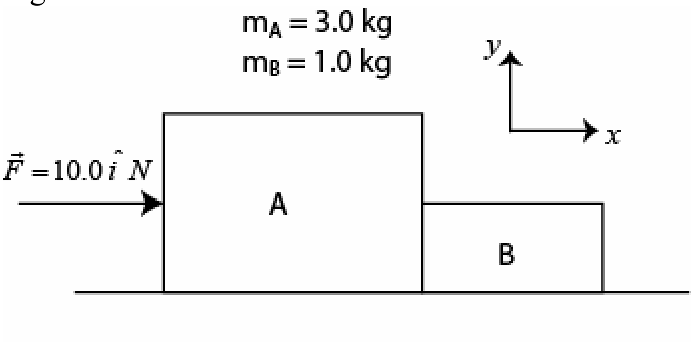

Figure 4

A) $\vec{F}_1 = 7.5\,\hat{i}\ N$ and $\vec{F}_2 = 2.5\,\hat{i}\ N$
B) $\vec{F}_1 = 5.0\,\hat{i}\ N$ and $\vec{F}_2 = -5.0\,\hat{i}\ N$
C) $\vec{F}_1 = 2.5\,\hat{i}\ N$ and $\vec{F}_2 = 7.5\,\hat{i}\ N$
D) $\vec{F}_1 = 0\ N$ and $\vec{F}_2 = 0\ N$
E) $\vec{F}_1 = 2.5\,\hat{i}\ N$ and $\vec{F}_2 = -2.5\,\hat{i}\ N$

Q19.
Two boxes, one of mass *m* = 5.00 *kg* and the other with an unknown mass *M* are connected with a string passing over a massless frictionless pulley and are placed on frictionless planes as shown in Fig. 5.What must be the mass *M*, if it goes down the plane with an acceleration of *a* = 2.45 m/s^2?

Fig#

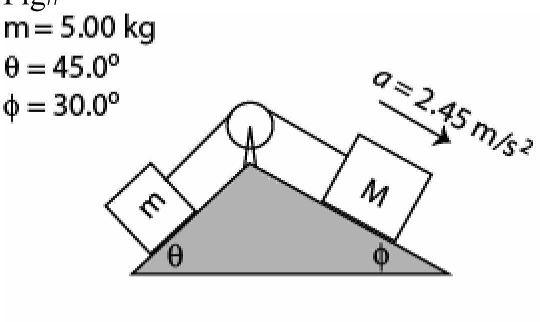

Figure 5

A) 19.1 *kg*
B) 8.70 *kg*
C) 13.5 *kg*
D) 2.50 *kg*
E) 10.0 *kg*

Q20.

A 2.00-*kg* mass is hanging from the ceiling of an elevator accelerating upward at a = 2.50 m/s^2 (see Fig. 6). What is the tension *T* in the string?

Fig#

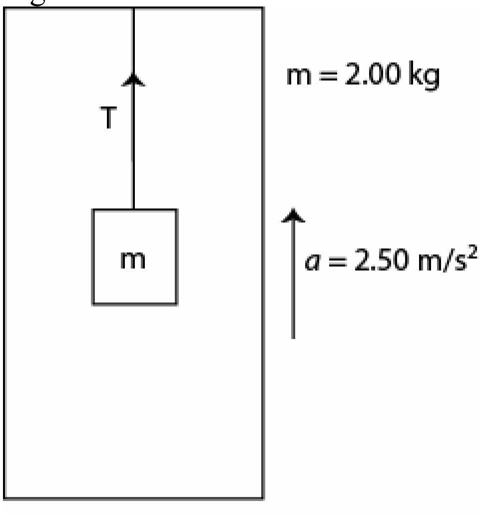

Figure 6

A) 24.6 *N*
B) 19.8 *N*
C) 27.7 *N*
D) 33.4 *N*
E) 5.50 *N*