Q1.
What is the height of a 2.913 kg solid gold cylinder whose radius is 2 cm? The density of gold is 19.32 g/cm^3.

A) 12 cm
B) 6 cm
C) 7 cm
D) 15 cm
E) 3 cm

Q2.
What is the dimension of the constant G in the equation: $F=Gm_1m_2/r^2$ where F is force, m_1 and m_2 are masses and r is the distance between the two masses.

A) $L^3M^{-1}T^{-2}$
B) LM^{-2}
C) L^2M^{-3}
D) MTL^{-2}
E) ML^2T^{-1}

Q3.
The velocity-time graph of a train traveling in a straight line from station A to station B, 10 km away, is shown in Figure 1. The train starts from A at t = 0 and arrives at B at t = T hours later. Find the acceleration of the train during the first half of the trip.

A) 1000 km/h^2
B) 2000 km/h^2
C) 3000 km/h^2
D) 6000 km/h^2
E) 1200 km/h^2

Q4.
A person throws down a stone into a well with an initial speed of 10 m/s. It takes the stone 3 s to reach the surface of the water in the well. What is the distance traveled by the stone to reach the surface of the water?

A) 74.1 m
B) 35.4 m
C) 60.2 m
D) 14.1 m
E) 44.1 m

Q5.
The displacement of a car is given by $x = 5t^2 – 20t + 10$, where x is in meters and t is in seconds. The car was initially moving towards the East. At what time does it change direction and move towards the West?

A) 2 s
B) 1 s
C) 4 s
D) 0.5 s
E) Never

Q6.
A man leaves his home driving his car for one hour at an average speed of 90 km/h before running out of gas. He then gets out of his car and walks a distance of 10 km in 3 hours before reaching a gas station. The average speed of the man during the whole trip between his home and the gas station is

A) 25 km/h
B) 95 km/h
C) 20 km/h
D) 45 km/h
E) 35 km/h

Q7.
A boat travels a distance of 27.0 km 20.0^{o} North of East. It then travels 53.0 km in a direction 30.0^{o} East of North. What is the total distance traveled by the boat in the East direction?

A) 51.9 km
B) 66.2 km
C) 71.3 km
D) 80.0 km
E) 82.7 km

Q8.
Consider two vectors $\vec{\mathbf{A}}$ and $\vec{\mathbf{B}}$ with magnitudes 5 cm and 8 cm, respectively. Vector $\vec{\mathbf{A}}$ is along the positive x-axis and vector $\vec{\mathbf{B}}$ is along the positive y-axis. Find $\vec{\mathbf{A}} \cdot (\vec{\mathbf{A}} + \vec{\mathbf{B}})$.

A) 25 cm^2
B) 13 cm^2
C) 40 cm^2
D) 64 cm^2
E) 94 cm^2

Q9.
Consider the following three vectors $\vec{\mathbf{A}} = 5\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 5\hat{\mathbf{k}}$, $\vec{\mathbf{B}} = -2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$, and $\vec{\mathbf{C}} = \hat{\mathbf{i}} - 2\hat{\mathbf{j}} - 3\hat{\mathbf{k}}$. Find the magnitude of the vector $\vec{\mathbf{D}} = \vec{\mathbf{A}} - \vec{\mathbf{B}} + 2\vec{\mathbf{C}}$.

A) 17.7

B) 24.5
C) 14.6
D) 11.5
E) 45.1

Q10.
A ball, thrown vertically down, hits a horizontal floor with a speed of 10 m/s and bounces back with the same speed. The change in its velocity is

A) 20 m/s up
B) zero
C) 20 m/s down
D) 40 m/s up
E) 40 m/s down

Q11.
A ball is thrown horizontally with a speed of 10 m/s from a height of 490 m above ground. Find the horizontal distance traveled by the ball when it hits the ground.

A) 100 m
B) 120 m
C) 205 m
D) 70.1 m
E) 40.9 m

Q12.
Rain is falling vertically at a constant speed of 7 m/s relative to an observer on the ground. At what angle to the vertical do the rain drops appear to be falling as viewed by the driver of a car traveling on a straight horizontal road at a speed of 20 m/s?

A) 70.7^{o}
B) 51.5^{o}
C) 69.5^{o}
D) 80.5^{o}
E) 45.0^{o}

Q13.
At t = 0, a particle is moving in the xy-plane with a velocity of $4\hat{\mathbf{j}}$ m/s and a constant acceleration of $(2\hat{\mathbf{i}}+4\hat{\mathbf{j}})$ m/s^2. Find the velocity of the particle at t = 3 s.

A) $(6\hat{\mathbf{i}}+16\hat{\mathbf{j}})$ m/s
B) $6\hat{\mathbf{i}}$ m/s
C) $(6\hat{\mathbf{i}}+12\hat{\mathbf{j}})$ m/s

D) $12\hat{\mathbf{j}}$ m/s

E) $(2\hat{\mathbf{i}} + 8\hat{\mathbf{j}})$ m/s

Q14.
Which one of the following is NOT an example of accelerated motion?

A) The horizontal component of a projectile motion
B) The vertical component of a projectile motion
C) A circular motion at constant speed
D) A swinging pendulum
E) The earth's motion about the sun

Q15.
Two masses m_1 = 10 kg and m_2 = 20 kg are connected by a light string and pulled across a frictionless surface by a horizontal force F = 30 N as shown in Figure 2. Find the tension in the string.

A) 10 N
B) 20 N
C) 30 N
D) 2.0 N
E) 25 N

Q16.
A 5.0-kg block and a 10-kg block are connected by a light string as shown in Figure 3. If the pulley is massless and the surface is frictionless, the magnitude of the acceleration of the 5.0 kg block is

A) 6.5 m/s^2
B) 3.3 m/s^2
C) 1.6 m/s^2
D) 4.9 m/s^2
E) 10 m/s^2

Q17.
A 70 kg man stands in an elevator that is moving downward at constant acceleration of 2.0 m/s^2. The force exerted by the man on the elevator floor is

A) 546 N down
B) 546 N up
C) 686 N down
D) 686 N up
E) 826 N down

Q18.

A block slides down an inclined plane at constant velocity. Which one of the following statements is TRUE?

A) A frictional force must be acting on it
B) A net downward force along the plane is acting on it
C) A net upward force along the plane is acting on it
D) Its acceleration is increasing
E) Its acceleration is decreasing

Q19.
A 1.0 kg block, attached to the end of a string of length 2.0 m, swings in a vertical circle. When the block is at its highest point, its speed is 5.0 m/s. What is the magnitude of the tension in the string at that point?

A) 2.7 N
B) 3.5 N
C) 4.6 N
D) 1.2 N
E) 10 N

Q20.
A block of mass m = 10 kg is pushed up a rough 30^{o} inclined plane by a force F parallel to the incline as shown in Figure 4. The coefficient of kinetic friction between the block and the plane is 0.4. Find the magnitude of the force F when the block is moving up at constant velocity.

A) 83 N
B) 15 N
C) 49 N
D) 20 N
E) 12 N

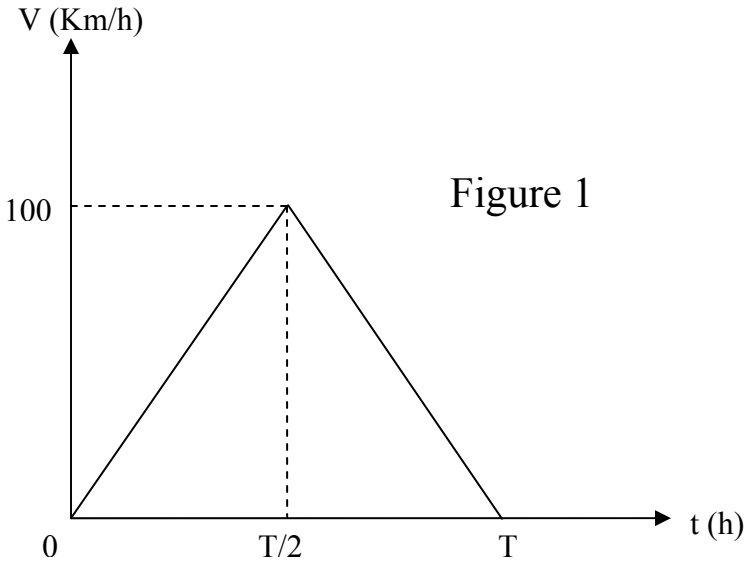

Figure 1

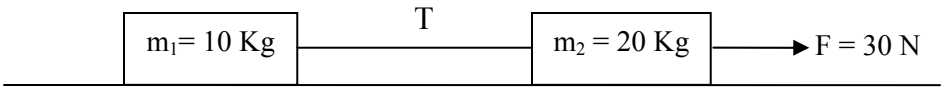

Figure 2

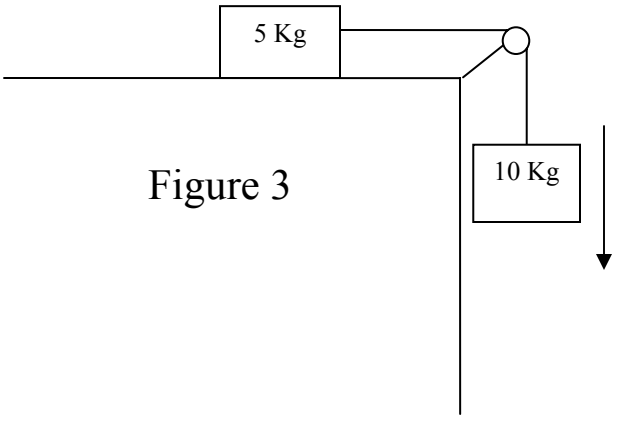

Figure 3

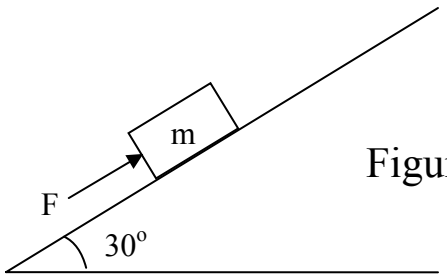

Figure 4