PHYS101-Term 112 – First Major – Zero Version

Q1. Express the speed of sound, 330 m/s in miles/h .(Take 1 mile = 1609 m)

A) 738 miles/h
B) 330 miles/h
C) 147 miles/h
D) 0.205 miles/h
E) 980 miles/h

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

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

Q3. A vector $\vec{A}$ is added to the sum of two vectors $\vec{B} = 3.0\hat{i} - 2.0\hat{j} - 2.0\hat{k}$ and $\vec{C} = 2.0\hat{i} - \hat{j} + 3.0\hat{k}$ such that $\vec{A} + \vec{B} + \vec{C} = \hat{k}$. The vector $\vec{A}$ is:

A) $-5.0\hat{i} + 3.0\hat{j}$
B) $5.0\hat{i} - 3.0\hat{j}$
C) $-3.0\hat{i} - 1.0\hat{j}$
D) $-1.0\hat{i} + 3.0\hat{j}$
E) $3.0\hat{j}$

Q4. Consider the vector $\vec{A} = 3.0\hat{i} + 4.0\hat{j}$. Which of the following vectors is perpendicular to vector $\vec{A}$:

A) $4.0\hat{i} - 3.0\hat{j}$
B) $3.0\hat{i} - 4.0\hat{j}$
C) $4.0\hat{i} + 3.0\hat{j}$
D) $-3.0\hat{i} - 4.0\hat{j}$
E) $3.0\hat{i} + 4.0\hat{j}$

Q5. Find the sum of the following two vectors: $\vec{A}$: 8.66 in +x-direction, $\vec{B}$: 10.0 , at 60° from +y-axis measured counterclockwise.

A) $5.00\,\hat{j}$
B) $3.00\,\hat{i} + 4.00\,\hat{j}$
C) $6.00\,\hat{i} + 8.00\,\hat{j}$
D) $8.66\,\hat{i} + 10.0\,\hat{j}$
E) $\hat{i} + 16.7\,\hat{j}$

Q6. Starting at time t = 0, an object moves along a straight line. Its coordinate in meters is given by $x(t) = 75t - 1.0t^3$, where t is in seconds. When it momentarily stops, its position is:

A) x = 250 m
B) x = 150 m
C) x = 300 m
D) x = 75 m
E) x = 350 m

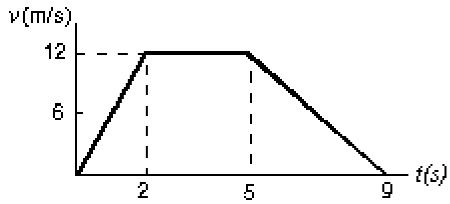
Q7. An object starts from rest at the origin and moves along the x axis with a constant acceleration of 4.0 m/s^2. Its average velocity as it goes from x = 2.0 m to x = 18.0 m is:

A) 8.0 m/s
B) 6.0 m/s
C) 3.0 m/s
D) 5.0 m/s
E) 1.0 m/s

Q8. A ball is thrown vertically upward. After 4.00 s the ball returned back to its initial position. The maximum height above the initial position of the ball is:

A) 19.6 m
B) 4.90 m
C) 9.8 m
D) 11.0 m
E) 15.0 m

Q9. **Figure 1** represents the straight line motion of a car. Which of the following statements is true?



A) The car accelerates at 6 m/s^2 for the first 2 s
B) The car accelerates, stops, and reverses
C) The car is moving for a total time of 12 s
D) The car decelerates at 12 m/s^2 for the last 4 s
E) The car returns to its starting point when t = 9 s

Q10. At $t = 0$, a car moves with initial velocity $\vec{v}_i = (3.0\,\hat{i} + 5.0\,\hat{j})$m/s . At $t = 2.0$ s, the velocity becomes $\vec{v}_f = (8.0\,\hat{i} - 7.0\,\hat{j})$m/s. What is the direction of the average acceleration of the car for the time interval from $t = 0$ to $t = 2.0$ s?

A) − 67° from the x-axis
B) 67° from the x-axis
C) 33° from the x-axis
D) − 33° from the x-axis
E) 52° from the x-axis

Q11. A particle moves in the *xy*-plane with a constant acceleration given by $\vec{a} = (-4.0\,\hat{j})$ m/s^2. At *t* = 0 its position vector and velocity are $\vec{r}_o = (10\ \hat{i})$ m and $\vec{v}_o = (-2.0\ \hat{i} + 8.0\ \hat{j})$ m/s, respectively. What is the distance of the particle from the origin at *t* = 2.0 s?

A) 10 m
B) 6.4 m
C) 8.9 m
D) 2.0 m
E) 6.2 m

Q12. A particle moves in the *xy*-plane in a circle centered on the origin. At a certain instant the velocity and acceleration of the particle are $(4.0\,\hat{j})$ m/s and $(-3.0\,\hat{i})$ m/s^2, respectively. What is the radius of the circle?

A) *x* = 5.3 m
B) *x* = 4.4 m
C) *x* = 1.3 m
D) *x* = 3.1 m
E) *x* = 2.2 m

Q13: A projectile is fired with an initial speed v_o directed at an angle θ_o above the horizontal. If the speed at maximum height is $\frac{v_o}{2}$, find the angle θ_o.

A) 60°
B) 76°
C) 30°
D) 45°
E) 55°

Q14: Relative to the air, a plane flies eastward at a speed of 156 m/s. A wind is blowing southward at a speed of 20.0 m/s, relative to the ground. The velocity of the plane relative to the ground is:

A) 157 m/s at an angle 7.31° south of east.
B) 170 m/s at an angle 82.7° south of east
C) 136 m/s at an angle 7.31° south of east
D) 136 m/s at an angle 7.31° east of south
E) 157 m/s at an angle 7.31° north of east

Q15. A ball of mass 0.50 kg attains acceleration, $\vec{a} = \left(4.0\,\hat{\text{i}} + 6.0\,\hat{\text{j}}\right)\text{m/s}^2$ as a result of two forces $\vec{F}_1$ and $\vec{F}_2$. If $\vec{F}_1 = \left(\text{A}\,\hat{\text{i}} - \text{B}\,\hat{\text{j}}\right)\text{N}$, and $\vec{F}_2 = \left(\text{B}\,\hat{\text{i}}\right)\text{N}$, where A and B are constants, find the value of A.

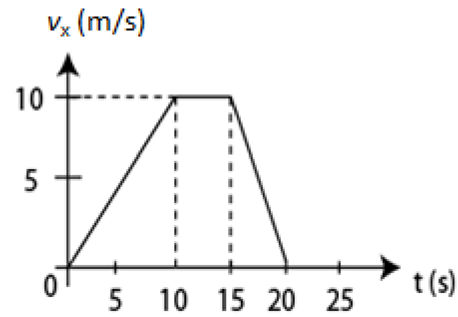
A) 5.0 N
B) 2.0 N
C) 4.0 N
D) 6.0 N
E) 0.50 N

Q16. A 70.0 kg person stands on a scale in an elevator. If the scale reading was 826 N, what is the acceleration of the elevator?

A) 2.00 m/s^2 upward
B) 2.00 m/s^2 downward
C) Zero
D) 5.00 m/s^2 upward
E) 5.00 m/s^2 downward

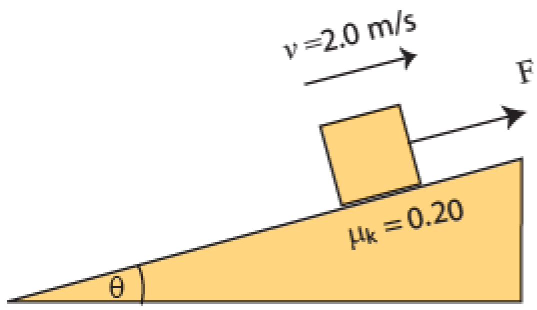
Q17. A 20 kg ball is travelling in a frictionless track along positive *x*-direction and its velocity/time graph is shown in **Figure 2**. The force experienced by the ball at 5th second is:

(Force is taken positive if it acts along positive *x*-axis)



A) 20 N
B) − 40 N
C) Zero
D) 5 N
E) − 10N

Q18. A block of mass 5.0 kg is pushed up in a θ = 30° incline plane with a force, F, parallel to a rough plane of coefficient of kinetic friction $\mu_k = 0.20$, as shown in **Figure 3**. What value of F is required to move the block up the plane at constant speed of $v = 2.0$ m/s?

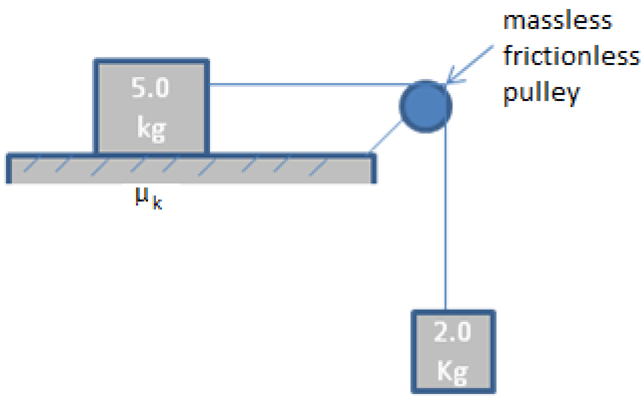


A) 33 N
B) 47 N
C) 98 N
D) 42 N
E) 8.5 N

Q19. A car, travelling on a circular horizontal road of radius 200 m, is almost about to slip. If the static coefficient of the road is 0.150, the speed of the car is:

A) 17.1 m/s
B) 294 m/s
C) 27.3 m/s
D) 9.45 m/s
E) 29.4 m/s

Q20. **Figure 4** shows two masses, of 5.0 kg and 2.0 kg, are tied together with a string that goes over a massless / frictionless pulley. The 5.0 kg body moves over a rough surface with coefficient of kinetic friction μ_k. If the system moves with constant speed 2.0 m/s, find the value of μ_k.



A) 0.40
B) 0.25
C) 0.71
D) 0.31
E) 0.13