Q1.
Consider two uniform solid spheres A and B made of the same material and having radii r_A and r_B, respectively. Find the ratio r_B / r_A if the mass of sphere B is five times the mass of sphere A.

A) 1.7
B) 2.2
C) 2.7
D) 1.2
E) 3.3

Q2.
The position *x* of a particle is given by

$$x = Rt^3 + \frac{H}{R}t^2$$

where *x* is in meters and t is in seconds. The dimension of H is

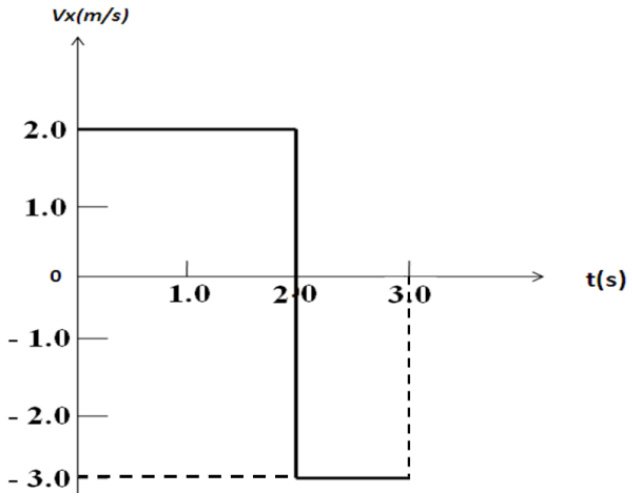
A) L^2T^{-5}
B) L^3T^{-2}
C) $L\,T^{-2}$
D) $ML^{-3}T^{-2}$
E) $ML\,T^{-5}$

Q3.
The velocity of a train is 80.0 km/h , due west. One and a half hour later its velocity decreases to 65.0 km/h, due west. What is the train's average acceleration ?

A) 10.0 km/h^2 due east
B) 10.0 km/h^2 due west
C) 43.3 km/h^2 due west
D) 43.3 km/h^2 due east
E) 53.3 km/h^2 due east

Q4.
A ball moves in a straight line along the x-axis and **Figure 1** shows its velocity as a function of time t. What is the ball average velocity and average speed, respectively, over a period of 3.00 s.

Fig#



A) 0.330 m/s, 2.33 m/s
B) 2.33 m/s , 0.330 m/s
C) 2.33 m/s , 2.33 m/s
D) 1.66 m/s, 2.33 m/s
E) 2.33 m/s, 1.66 m/s

Q5.
The position of an object moving along the x-axis is given by $x = 6.0 + 6.0\,t - 3.0\,t^2$, where x is in meters and t in seconds. Which statement about this object is ***correct***?

A) The object is momentarily at rest at $t = 1.0$ s.
B) The object position is negative at t = 0 s.
C) The acceleration of the object is zero at t = 0 s.
D) The acceleration of the object is positive at all times.
E) The object is momentarily at rest at t = 2.0 s.

Q6.
A rock is thrown vertically upward from ground level at time t =0.0 s. At t =1.5 s it passes the top of a tall tower, and then 1.0 s later it reaches its maximum height. What is the height of the tower?

A) 26 m
B) 62 m
C) 36 m
D) 16 m
E) 20 m

Q7.
A man walks 50 m in a direction 37^o north of east at 5.0 m/s, then 60 m south at 4.0 m/s. How long would it take him to get back to his starting point at 5.0 m/s by the shortest path?

A) 10 s
B) 15 s

C) 20 s
D) 5.0 s
E) 3.5 s

Q8.
Vector $\vec{A}$ has a magnitude of 35.0 m and makes an angle of 37.0^o with the positive x axis. Find a vector $\vec{B}$ that is in the direction opposite to vector $\vec{A}$ and is one fifth the magnitude of $\vec{A}$.

A) $-(5.59\text{ m})\,\hat{i} - (4.21\text{m})\,\hat{j}$
B) $(5.59\text{ m})\,\hat{i} + (4.21\text{ m})\,\hat{j}$
C) $(0.798\text{ m})\,\hat{i} - (0.602\text{ m})\,\hat{j}$
D) $-(1.56\text{ m})\,\hat{i} - (5.06\text{ m})\,\hat{j}$
E) $-(0.798\text{ m})\,\hat{i} + (0.602\text{ m})\,\hat{j}$

Q9.
If $\vec{A} = 2\hat{i} + 3\hat{j}$, $\vec{B} = \hat{i} - \hat{j}$ and $\vec{C} = \hat{i} + \hat{j}$, find $(\vec{A} \times \vec{B}) \cdot \vec{C}$.

A) 0
B) –6
C) +6
D) $-3\hat{k}$
E) $+2\hat{i}$

Q10.
The scalar product of vectors $\vec{A}$ and $\vec{B}$ is 6.00 and the magnitude of their vector product is 9.00. Find the angle between these two vectors.

A) 56.3^o
B) 43.0^o
C) 23.4^o
D) 37.5^o
E) 90.0^o

Q11.
The position of a particle is given by $\vec{r} = (4t - t^2)\,\hat{i} + t^3\,\hat{j}$, where $\vec{r}$ is in meters and t in seconds. Find the average acceleration (in m/s^2) of the particle in the time interval between t = 2 s and t = 4 s.

A) $-2\,\hat{i} + 18\,\hat{j}$
B) $-4\,\hat{i} - 6\,\hat{j}$

C) $-5\,\hat{i} - 10\,\hat{j}$
D) $-7\,\hat{i} - 12\,\hat{j}$
E) $-10\,\hat{i} - 6\,\hat{j}$

Q12.
A projectile is thrown from the ground into the air with an initial speed v_0. Its velocity, 1.50 s after it was thrown, is 42.3 m/s making an angle 30.4^0 above the horizontal. Determine the initial velocity v_0 of the projectile.

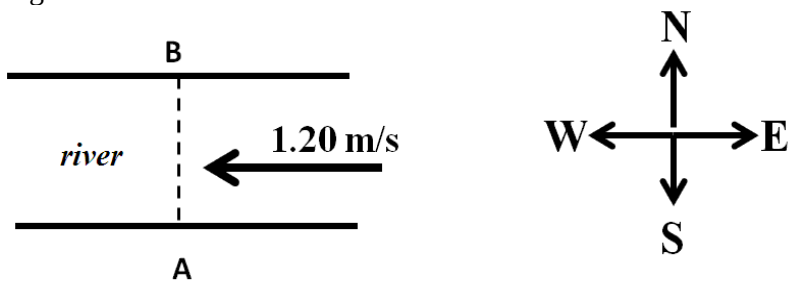
A) 51.3 m/s at 44.7^0 above the horizontal
B) 43.1 m/s at 34.2^0 above the horizontal
C) 21.6 m/s at 49.2^0 above the horizontal
D) 32.5 m/s at 23.5^0 above the horizontal
E) 12.2 m/s at 54.5^0 above the horizontal

Q13.
A 0.150 kg ball, attached to the end of a string, is revolving uniformly in a horizontal circle of radius 0.600 m. The ball makes 10.0 revolutions in 5.00 seconds. Calculate the centripetal acceleration of the ball?

A) 94.8 m/s^2
B) 25.7 m/s^2
C) 12.6 m/s^2
D) 9.81 m/s^2
E) zero

Q14.
A boat is to travel from point A to point B directly across a river. The water in the river flows with a velocity of 1.20 m/s toward the west, as shown in **Figure 3**. If the speed of the boat in still water is 1.85 m/s, at what angle from the north must the boat head?

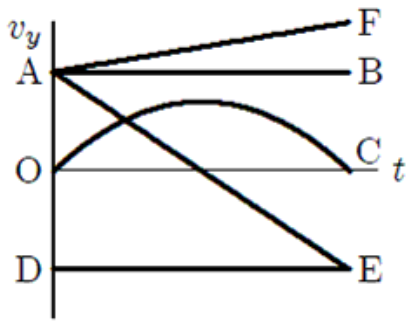
Fig#



40.4^0 east of north
B) 30.2^0 west of north
C) 10.5^0 east of north
D) 90.0^0 west of north
E) 55.0^0 west of north

Q15.
Which one of the curves shown in **Figure 2** best represents the vertical component of the velocity v_y versus time t for a projectile fired at an angle of 45^0 above the horizontal?

Fig#



A) AE
B) AB
C) OC
D) DE
E) AF