1. The airplane shown is in level flight at an altitude of 0.50 km and a speed of 150 km/h. At what distance $d$ should it release a heavy bomb to hit the target $X$? Take $g = 10\text{m/s}^2$.

![Diagram of airplane in level flight](image)

A. $150\text{m}$  
B. $295\text{m}$  
C. $420\text{m}$  
D. $2500\text{m}$  
E. $15,000\text{m}$

2. A large cannon is fired from ground level over level ground at an angle of $30^\circ$ above the horizontal. The muzzle speed is $980\text{m/s}$. Neglecting air resistance, the projectile will travel what horizontal distance before striking the ground?

$$R = \frac{V_0^2 \sin \theta}{g} = \frac{980^2 \sin (2 \times 30^\circ)}{9.8} = 85000\text{m}$$

A. $4.3\text{km}$  
B. $8.5\text{km}$  
C. $43\text{km}$  
D. $85\text{km}$  
E. $170\text{km}$

3. A dart is thrown horizontally toward $X$ at $20\text{m/s}$ as shown. It hits $Y$ $0.1$ s later. The distance $XY$ is:

$$y - y_0 = v_{oy} t - \frac{1}{2} g t^2$$

A. $1\text{m}$  
B. $2\text{m}$  
C. $0.5\text{m}$  
D. $0.1\text{m}$  
E. $0.05\text{m}$
4. A car travels east at constant velocity. The net force on the car is:

A. east
B. west
C. up
D. down
E. zero

5. A constant force of 8.0 N is exerted for 4.0 s on a 16-kg object initially at rest. The change in speed of this object will be:

A. 0.5 m/s
B. 2.0 m/s
C. 4.0 m/s
D. 8.0 m/s
E. 32 m/s

6. Two forces are applied to a 5.0-kg crate; one is 6.0 N to the north and the other is 8.0 N to the west. The magnitude of the acceleration of the crate is:

A. 0.50 m/s²
B. 2.0 m/s²
C. 2.8 m/s²
D. 10 m/s²
E. 50 m/s²

7. A 1000-kg elevator is rising and its speed is increasing at 3 m/s². The tension force of the cable on the elevator is:

A. 6400 N
B. 1000 N
C. 3000 N
D. 9800 N
E. 12800 N

8. The speed of a 4.0-N hockey puck, sliding across a level ice surface, decreases at the rate of 0.61 m/s². The coefficient of kinetic friction between the puck and ice is:

A. 0.062
B. 0.41
C. 0.62
D. 1.2
E. 9.8

9. A 40-N crate rests on a rough horizontal floor. A 12-N horizontal force is then applied to it. If the coefficients of friction are $\mu_s = 0.5$ and $\mu_k = 0.4$, the magnitude of the frictional force on the crate is:

A. 8 N
B. 12 N
C. 16 N
D. 20 N
E. 40 N
10. A car is traveling at 15 m/s on a horizontal road. The brakes are applied and the car skids to a stop in 4.0 s. The coefficient of kinetic friction between the tires and road is:

A. 0.38  
B. 0.69  
C. 0.77  
D. 0.92  
E. 1.11

\[
\begin{align*}
\mathbf{v}_t &= 0 \\
\mathbf{a} &= \frac{\mathbf{v} - \mathbf{v}_0}{t - t_0} = \frac{0 - 15}{4 - 0} = -3.75 \text{ m/s}^2
\end{align*}
\]

11. If \( M = 2.0 \text{ kg} \), what is the tension in string 1?

A. 1.2 N  
B. 11 N  
C. 34 N  
D. 3.5 N  
E. 40 N

\[
\text{Ans: C}
\]

12. If the only forces acting on a 2.0-kg mass are \( \mathbf{F}_1 = (3\mathbf{i} - 8\mathbf{j}) \text{ N} \) and \( \mathbf{F}_2 = (5\mathbf{i} + 3\mathbf{j}) \text{ N} \), what is the magnitude of the acceleration of the particle?

A. 1.5 m/s\(^2\)  
B. 6.5 m/s\(^2\)  
C. 4.7 m/s\(^2\)  
D. 9.4 m/s\(^2\)  
E. 7.2 m/s\(^2\)

\[
\begin{align*}
\mathbf{F}_{\text{net}} &= \mathbf{F}_1 + \mathbf{F}_2 = (3\mathbf{i} - 8\mathbf{j}) + (5\mathbf{i} + 3\mathbf{j}) \\
&= 8\mathbf{i} - 5\mathbf{j} \\
|\mathbf{F}_{\text{net}}|^2 &= (8)^2 + (-5)^2 = 9.43 \\
|\mathbf{a}| &= \frac{|\mathbf{F}_{\text{net}}|}{m} = \frac{9.43}{2} = 4.72 \text{ m/s}^2
\end{align*}
\]
13. If \( F = 4.0 \text{ N} \) and \( m = 2.0 \text{ kg} \), what is the magnitude \( a \) of the acceleration for the block shown below? The surface is frictionless.

![Diagram of a block with forces labeled.]

A. 5.3 m/s\(^2\)  
B. 4.4 m/s\(^2\)  
C. 3.5 m/s\(^2\)  
D. 7.0 m/s\(^2\)  
E. 8.4 m/s\(^2\)  

14. A projectile is fired over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. Using \( g = 10 \text{ m/s}^2 \), the distance from launching to landing points is below?

![Diagram of a projectile.]

A. 40 m  
B. 60 m  
C. 80 m  
D. 120 m  
E. 180 m  

15. A 3.0-kg block slides on a frictionless 20\(^\circ\) inclined plane. A force of 16 N acting parallel to the incline and up the incline is applied to the block. What is the acceleration of the block?

![Diagram of a block on an inclined plane.]

A. 2.0 m/s\(^2\) down the incline  
B. 5.3 m/s\(^2\) up the incline  
C. 2.0 m/s\(^2\) up the incline  
D. 3.9 m/s\(^2\) down the incline  
E. 3.9 m/s\(^2\) up the incline