1. The rate of change of velocity with time is called _____.

   _____

2. When may the equations of motion be used? Select **all** that apply.

   ☐ for free fall with air resistance neglected

   ☐ for a body slowing under air resistance

   ☐ when the acceleration is constant in direction

   ☐ when the acceleration is constant in magnitude

   Tick every correct option.

3. A ball thrown horizontally and a ball dropped from the same height hit the ground at the same time (no air resistance).

   ☐ True ☐ False

4. Which quantity is the **rate of change of displacement**?

   ☐ speed

   ☐ acceleration

   ☐ velocity

   ☐ distance

5. A car starts at $u = 2\ \frac{\text{m}}{\text{s}}$ and accelerates at $a = 3\ \frac{\text{m}}{\text{s}^2}$ for $t = 4$ s. Find v.

   _____ m/s

6. A projectile is launched at $20\ \frac{\text{m}}{\text{s}}$, 30° above the horizontal. What is the **vertical** part of the launch velocity?

   _____ m/s

7. Deceleration is a completely separate quantity from acceleration.

   ☐ True ☐ False

8. A car travelling at $25\ \frac{\text{m}}{\text{s}}$ brakes steadily and stops in 40 m. What is the size of its deceleration?

   _____ m/s^2

9. Select **all** the statements that are true for a projectile (ignore air).

   ☐ The path is a parabola

   ☐ The vertical velocity is zero at the highest point

   ☐ A heavier projectile falls faster

   ☐ The horizontal velocity stays constant

   Tick every correct option.

10. On a displacement–time graph, a flat (horizontal) line means the object is at rest.

    ☐ True ☐ False

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1. **acceleration**

   Acceleration is how fast the velocity changes – a vector, in $\frac{\text{m}}{\text{s}^2}$.

2. **for free fall with air resistance neglected; when the acceleration is constant in direction; when the acceleration is constant in magnitude**

   Air resistance makes the acceleration change, so only graph methods work there. A curved velocity-time graph is the visible warning.

3. **True**

   Yes – the vertical motion is the same free fall for both, and the horizontal speed does not change the fall time.

4. **velocity**

   Velocity is the rate of change of *displacement* (a vector). Speed is the rate of change of *distance* (a scalar).

5. **14 m/s**

   Use $v = u + at = 2 + 3 \times 4 = 14\ \frac{\text{m}}{\text{s}}$.

6. **10 m/s**

   Vertical part $= u \sin\theta = 20 \times \sin 30° = 20 \times 0.5 = 10\ \frac{\text{m}}{\text{s}}$.

7. **False**

   No – deceleration is just acceleration in the opposite direction to the motion (a negative acceleration).

8. **7.8 m/s^2**

   Time is not given or wanted, so use $v^2 = u^2 + 2as$. $a = \frac{0 - 25^2}{2 \times 40} = -7.8\ \frac{\text{m}}{\text{s}^2}$; the size is $7.8\ \frac{\text{m}}{\text{s}^2}$.

9. **The path is a parabola; The vertical velocity is zero at the highest point; The horizontal velocity stays constant**

   At the top only the *vertical* velocity is zero – the horizontal velocity $u \cos\theta$ carries on, so the ball keeps moving. Mass does not change free fall.

10. **True**

    A flat line has zero gradient, and the gradient is the velocity – so the velocity is zero (at rest).

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