

## **Chapter 2: MOTION ALONG A STRAIGHT LINE**

Choose the correct answer:

1. Suppose the motion of a particle is described by the equation:  $X = 20 + 4 t^2$ . Find the **instantaneous velocity at  $t = 5 \text{ s}$**  ?

(a) 16 m/s                      (b) 60 m/s                      (c) 40 m/s                      (d) 36 m/s

2. A ball thrown vertically upward with an initial velocity of **12 m/s**, **what is the ball's maximum height?**

(a) 7.35 m                      (b) 14.7 m                      (c) 0.61 m                      (d) 1.22 m

3. A body moves along the x-axis with constant acceleration  $a = 4 \text{ m/s}^2$ . At  $t=0$  the body is at  $x_0=5 \text{ m}$  and has velocity  $v_0 = 3 \text{ m/s}$ . Find its **position at  $t = 2 \text{ s}$**  ?

(a) 14 m                      (b) 19 m                      (c) 15 m                      (d) 18 m

4. Suppose the velocity of the particle is given by the:  $v = 10 + 2 t^2$  where  $v$  is in m/s and  $t$  is in s. Find **the change in velocity** of the particle in the time interval between  $t_1 = 2 \text{ s}$  and  $t_2 = 5 \text{ s}$  ?

(a) 41 m/s                      (b) 14 m/s                      (c) 24 m/s                      (d) 42 m/s

5. In question 4, Find **the instantaneous acceleration when  $t = 2 \text{ s}$**  ?

(a)  $4 \text{ m/s}^2$                       (b)  $14 \text{ m/s}^2$                       (c)  $8 \text{ m/s}^2$                       (d)  $18 \text{ m/s}^2$

6. Which pair of the following **initial and final positions** along the x-axis give a **positive displacement**?

(a) - 3m, +5m                      (b) - 3m, - 4m                      (c) 5m, - 3m                      (d) 4m, 3m

7. You walk a distance **1.22 m in 1 s** and then run a distance **3.05 m in 1 s**, what is your **average speed**?

(a) 0.92 m/s                      (b) 4.27 m/s                      (c) 2.14 m/s                      (d) 1.83 m/s

8. The following are equations of the velocity  $v(t)$  of a particle, in which situation the **acceleration is constant**?

(a)  $v = 3t + 6$                       (b)  $v = 4 t^2$                       (c)  $v = 3 t^2 - 4 t$                       (d)  $v = 5 t^3 - 3$

9. A particle's position on the x-axis is given by  $X = 8 - 5 t + 25 t^2$ , with X in meters and t in seconds. Find the particles **velocity function**?

(a)  $v = -5 + 25 t$                       (b)  $v = -5 + 50 t$                       (c)  $v = 8 - 5 + 25 t$                       (d)  $v = 8 + 5 + 50 t$

10. A rocket ship moves with **constant acceleration** equal to  $9.8 \text{ m/s}^2$ , if it starts from rest **how long** will it take to reach a velocity  $\frac{1}{10}$  the velocity of light? ( $V_{\text{light}} = 3 \times 10^8 \text{ m/s}$ )
- (a)  $3.1 \times 10^5 \text{ s}$       (b)  $3.1 \times 10^7 \text{ s}$       (c)  $3.1 \times 10^6 \text{ s}$       (d)  $3.1 \times 10^4 \text{ s}$
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11. In **question 10**, **how far** will the rocket ship travel?
- (a)  $4.6 \times 10^{13} \text{ m}$       (b)  $4.6 \times 10^{10} \text{ m}$       (c)  $4.6 \times 10^{12} \text{ m}$       (d)  $4.6 \times 10^{11} \text{ m}$
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12. A ball thrown vertically upward with an initial velocity of **12 m/s**, **how long** does the ball take to reach its **maximum height**?
- (a) 0.74 s      (b) 1.35 s      (c) 0.82 s      (d) 1.22 s
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13. A car moving with a constant acceleration covered a **distance** between two points **60 m** apart in **6 s**, what was its **initial speed** if the **final speed was 15 m/s**?
- (a) -10 m/s      (b) -5 m/s      (c) 5 m/s      (d) 17.5 m/s
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14. The **instantaneous acceleration** a equals:
- (a)  $\frac{dx}{dt}$       (b)  $\frac{d}{dt}\left(\frac{d^2x}{dt^2}\right)$       (c)  $\frac{d^2}{dt^2}\left(\frac{dx}{dt}\right)$       (d)  $\frac{d}{dt}\left(\frac{dx}{dt}\right)$
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15. Suppose the motion of a particle is described by the equation:  **$X = 20 + 4t^2$** . Find the **average velocity** of the particle in the time interval  **$t_1=2 \text{ s}$  to  $t_2=5 \text{ s}$**  ?
- (a) 29 m/s      (b) 28 m/s      (c) 84 m/s      (d) 10 m/s
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16. In **question 15**, Find the **instantaneous velocity at  $t = 5 \text{ s}$**  ?
- (a) 16 m/s      (b) 60 m/s      (c) 40 m/s      (d) 36 m/s
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17. A rock is dropped from rest from the top of a **100 m** tall building, **how long does it take to fall the first 50 m** ?
- (a) 3.2 s      (b) 10.2 s      (c) 20.4 s      (d) 4.5 s
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18. The following are equations of the position of a particle, in which situation the **velocity of the particle is constant** ?
- (a)  $x = 4t^2 - 2$       (b)  $x = -2t^3$       (c)  $x = -3t - 2$       (d)  $x = 4t^{-2}$
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19. A ball thrown vertically upward with an initial velocity of **12 m/s**, **what is the ball's maximum height**?
- (a) 7.35 m      (b) 14.7 m      (c) 0.61 m      (d) 1.22 m

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- 20.** A body moves along the x-axis with constant acceleration  $a = 4 \text{ m/s}^2$ . At  $t=0$  the body is at  $x=5 \text{ m}$  and has velocity  $v = 3 \text{ m/s}$ . Find its **position at  $t = 2 \text{ s}$**  ?
- (a) 14 m                      (b) 19 m                      (c) 15 m                      (d) 18 m
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- 21.** In question 20, where is the body when its velocity is **5 m/s** ?
- (a) 7 m                      (b) 9 m                      (c) 11 m                      (d) 2 m
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- 22.** A man runs a distance of **1 mile** in exactly **4 minutes**, What is his **average velocity** in **mi/hr** ?
- (a) 900 mi/hr                      (b) 15 mi/hr                      (c) 6.71 mi/hr                      (d) 15000 mi/hr
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- 23.** You walk a distance of **73.2 m** at a speed of **1.22 m/s** and then run **73.2 m** in **24 s**. What is your overall **displacement**?
- (a) 97.2 m                      (b) 73.2 m                      (c) 146.4 m                      (d) zero
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- 24.** In question 23, what is the **time interval** from the start to the end?
- (a) 24 s                      (b) 84 s                      (c) 36 s                      (d) 4.27 s
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- 25.** If  $t_1=2 \text{ s}$  and  $t_2=4 \text{ s}$  find the **average acceleration** when the velocity changes from **8 m/s** to **12 m/s**?
- (a)  $1 \text{ m/s}^2$                       (b)  $3.33 \text{ m/s}^2$                       (c)  $5 \text{ m/s}^2$                       (d)  $2 \text{ m/s}^2$
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- 26.** What is the **initial speed** of a car moving a **distance** of **60 m** in **6 s** if the **final speed** was **15 m/s**?
- (a) -10 m/s                      (b) -5 m/s                      (c) 5 m/s                      (d) 17.5 m/s
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- 27.** If the total distance moved by a bus before stopping was **56.7 m** with **initial speed** of **22.36 m/s**. What is the magnitude of the **acceleration**?
- (a)  $8.82 \text{ m/s}^2$                       (b)  $4.41 \text{ m/s}^2$                       (c)  $17.63 \text{ m/s}^2$                       (d)  $2.21 \text{ m/s}^2$
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- 28.** A pipe dropped from a building struck the ground with a **speed of 24 m/s**. what **height** was it dropped from?
- (a) 58.8 m                      (b) 2.44 m                      (c) 1.22 m                      (d) 29.4 m
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- 29.** What is the **initial speed** of a ball thrown upward vertically reaching a **height of 0.544 m** in **0.2 s** ?
- (a) 4.68 m/s                      (b) 3.7 m/s                      (c) 2.1 m/s                      (d) 0.74 m/s
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**30.** The **initial and the final positions** of a particle moving along the x-axis are **-2 m, 10 m**, then its **displacement  $\Delta x$**  equals:

- (a) +12 m                      (b) +8 m                      (c) -12 m                      (d) -8 m

**31.** In which situation of the following the displacement is **positive**?

| Situation | $X_1(m)$ | $X_2(m)$ |
|-----------|----------|----------|
| <b>A</b>  | -3       | 5        |
| <b>B</b>  | -3       | -7       |
| <b>C</b>  | -3       | -3       |
| <b>D</b>  | 2        | 5        |

- (a) **A and B**                      (b) **A and C**                      (c) **A and D**                      (d) **B and C**

**32.** The position of a body moving along the x axis is given by  **$x = 3t - 4t^2 + t^3$**  . Its position at  **$t = 2$  s** is:

- (a) 6 m                      (b) 2 m                      (c) -6 m                      (d) -2 m

**33.** In question 32, the **displacement** of the object in the time interval  **$t = 0$  to  $t = 4$  s** is:

- (a)  $\Delta x = 3m$                       (b)  $\Delta x = 12m$                       (c)  $\Delta x = -3m$                       (d)  $\Delta x = -12m$

**34.** A car travelled **40 km in 0.5 h**, then travelled **40 km in 1 h**. Its **average speed** is:

- (a) 26.7 km/h                      (b) 160 km/h                      (c) 80 km/h                      (d) 53.3 km/h

**35.** A car starts from point **A** moved a distance **50 km** to point **B** then returns to point **A** in a time interval of **2 hours**. Its **average velocity** is:

- (a) zero                      (b) 50 km/h                      (c) 100 km/h                      (d) 25 km/h

**36.** The position of a particle moving along the x-axis is given by:  **$x = 2t^3$**  . Its **acceleration** is:

- (a)  $6t^2 \text{ m/s}^2$                       (b)  $12t \text{ m/s}^2$                       (c) constant                      (d) zero

**37.** A ball dropped from a building ,its **velocity and position** after **1 s** are:

- (a)  $V = -9.8 \text{ m/s}$   
 $y = -9.8 \text{ m}$                       (b)  $V = -4.9 \text{ m/s}$   
 $y = -9.8 \text{ m}$                       (c)  $V = -9.8 \text{ m/s}$   
 $y = -4.9 \text{ m}$                       (d)  $V = -4.9 \text{ m/s}$   
 $y = -4.9 \text{ m}$

**38.** An electron has an initial velocity  $V_0 = 1 \times 10^5 \text{ m/s}$  travels a distance **0.01 m**, if the final velocity was  $V = 2 \times 10^6 \text{ m/s}$ , then its **acceleration is**:

- (a)  $1995 \times 10^{14} \text{ m/s}^2$     (b)  $195 \times 10^6 \text{ m/s}^2$     (c)  $95 \times 10^6 \text{ m/s}^2$     (d)  $1.995 \times 10^{14} \text{ m/s}^2$

**39.** A particle moving in the **+ x direction** with **increasing speed** :

- (a) Its velocity is positive and acceleration is negative  
 (b) Its velocity is negative and acceleration positive  
 (c) Its velocity and acceleration are both positive  
 (d) Its velocity is positive and acceleration is zero

**40.** In which situation of the following the **velocity** is in the **negative x** direction?

| Situation | Position of the particle |
|-----------|--------------------------|
| <b>A</b>  | $X = -2t^2 - 2$          |
| <b>B</b>  | $X = 3t^3 - 5$           |
| <b>C</b>  | $X = -2t^{-2} + 1$       |
| <b>D</b>  | $X = -5 + 5t$            |

- (a) **A**                      (b) **B**                      (c) **C**                      (d) **D**

**41.** A ball is thrown vertically upward. Its **displacement** is:

- (a) positive during rising and negative during falling  
 (b) negative during rising and positive during falling  
 (c) positive during rising and falling  
 (d) negative during rising and falling

**42.** A man walks **4 m** from point A **due east**, then **3 m due north**. What is his **displacement** from the point A?

- (a) 7 m                      (b) 6 m                      (c) 5 m                      (d) 10 m

**43.** The following are equations of the velocity  $v(t)$  of a particle, in which situation the **acceleration is constant**?

- (a)  $v = 3t + 6$                       (b)  $v = 4t^2$                       (c)  $v = 3t^2 - 4t$                       (d)  $v = 5t^3 - 3$

**44.** You are throwing a ball straight up in the air. At the highest point, the ball's velocity and acceleration are:

- (a)  $v = 0$   
 $a = -g$                       (b)  $v = v_0$   
 $a = 0$                       (c)  $v > v_0$   
 $a = -g$                       (d)  $v < v_0$   
 $a < -g$

**45.** If the **sign** of the **velocity and acceleration** of a particle are **opposite**, then the **speed of the particle**

- (a) is zero                      (b) decreases                      (c) increases                      (d) does not change

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46. A particle moves **from  $x_1 = 5 \text{ m}$  to  $x_2 = 12 \text{ m}$** , then:

- (a)  $\Delta x$  is positive      (b)  $\Delta x$  is negative      (c)  $\Delta x$  is zero      (d)  $\Delta x = 12 \text{ m}$

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47. You **walked a distance of 2 km** along a road in **0.5 h**, then walked back to **the initial position in 0.75 h**. Your overall **displacement** is:

- (a) 6 km      (b) 0      (c) 4 km      (d) 2 km

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48. In question 62, your **average speed** is :

- (a) 5.3 km/h      (b) 1.6 km/h      (c) 3.2 km/h      (d) 0

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49. The position of a car changes from  **$x_1 = 20 \text{ m}$  to  $x_2 = 100 \text{ m}$**  in the **time interval** from **2s to 4s**, the **average velocity** of the car is:

- (a) 40 m/s      (b) 30 m/s      (c) 45 m/s      (d) 25 m/s

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50. The position of a particle is given by:  **$x(t) = 10 + t^2$** , the **instantaneous acceleration** at  **$t = 1 \text{ s}$**  is:

- (a)  $8 \text{ m/s}^2$       (b)  $6 \text{ m/s}^2$       (c)  $4 \text{ m/s}^2$       (d)  $2 \text{ m/s}^2$

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51. The **free fall acceleration** is:

- (a) zero      (b)  $-9.8 \text{ m/s}^2$       (c)  $+9.8 \text{ m/s}^2$       (d)  $-32 \text{ m/s}^2$

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52. In which situation of the following the **velocity is constant** ?

| Situation | Position of the particle         |
|-----------|----------------------------------|
| <b>A</b>  | <b><math>X = 3t - 2</math></b>   |
| <b>B</b>  | <b><math>X = 2t^2 - 2</math></b> |
| <b>C</b>  | <b><math>X = -2t^3</math></b>    |
| <b>D</b>  | <b><math>X = 2 - 5t^2</math></b> |

- (a) **A**      (b) **B**      (c) **C**      (d) **D**

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53. A car starts from rest, travels with constant acceleration a distance **500 m**, the final velocity is **50 m/s**. Its **acceleration** is:

- (a)  $1.6 \text{ m/s}^2$       (b)  $2.5 \text{ m/s}^2$       (c)  $3.6 \text{ m/s}^2$       (d)  $4.9 \text{ m/s}^2$

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54. The equation that represents the **motion with constant acceleration** is:

- (a)  $v^2 = v_0^2 + 2at$       (b)  $v = v_0 + 2a(x - x_0)$       (c)  $x - x_0 = v_0t + \frac{1}{2}at^2$       (d)  $v = v_0 + \frac{1}{2}at^2$

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**55.** When an object is thrown **vertically upward**  $\uparrow$ , while it is **rising**:

- (a) its velocity and acceleration are both upward  $\uparrow$
- (b) its velocity is upward  $\uparrow$  and its acceleration is downward  $\downarrow$
- (c) its velocity and acceleration are both downward  $\downarrow$
- (d) its velocity is downward  $\downarrow$  and its acceleration is upward  $\uparrow$

**Are the following statements (True  $\checkmark$ ) or (False  $\times$ ) ?**

**56.** Speed is the magnitude of instantaneous velocity.

- (a) True                      (b) False

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**57.** Average acceleration is the ratio of (النسبة بين) the change of velocity  $\Delta v$  to the time interval  $\Delta t$ .

- (a) True                      (b) False

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**58. The free fall motion** is an example of motion along a straight line with constant acceleration.

- (a) True                      (b) False