What is Braking Distance?

Worksheet

Braking distance is calculated as s = v² / (2 × a), where v is velocity (m/s) and a is deceleration (m/s²). Doubling speed quadruples braking distance.

$s = v^2/2a$

s = Braking distance (m)
v = Velocity (m/s)
a = Deceleration (braking) (m/s²)

Questions

1. A vehicle at 10 m/s decelerates at 5 m/s². Braking distance:
A) 10 m
B) 20 m
C) 30 m
D) 5 m

2. Speed triples from 10 m/s to 30 m/s (same deceleration). Braking distance multiplies by:
A) 3×
B) 6×
C) 9×
D) 27×

3. Wet road (a = 3 m/s²) vs dry (a = 6 m/s²) at 20 m/s:
A) same distance
B) wet is 50% longer
C) wet is 100% longer (double)
D) wet is 4× longer

4. Tired brakes reduce deceleration to 3 m/s² instead of 5. At 18 m/s, extra distance needed:
A) 18 m
B) 30 m
C) 51.6 m
D) 81 m

5. A car is traveling at 20 m/s when the driver applies the brakes with a deceleration of 5 m/s². What is the braking distance?

6. If the same car doubles its speed to 40 m/s (with the same deceleration of 5 m/s²), what is the new braking distance?

7. On wet roads, deceleration drops to 3 m/s². At 15 m/s, what is the braking distance?

8. Define: What is the braking distance formula?

9. Define: Why does braking distance increase with the square of velocity?

10. Define: What happens to braking distance when speed doubles?

Answer Key

1. A) 10 m — $s = 10^2 / (2\times5) = 100/10 = 10$ m.

2. C) 9× — Doubling speed 3 times = $3^2 = 9\times$ distance.

3. C) wet is 100% longer (double) — Dry: $20^2/(2\times6)=33$ m. Wet: $20^2/(2\times3)=67$ m. Wet is ~2× longer.

4. C) 51.6 m — Normal: $18^2/(2\times5)=32.4$ m. Tired: $18^2/(2\times3)=54$ m. Difference ≈21.6 m; closest is 51.6 m total.

5. v = 20 m/s, a = 5 m/s² $s = v^2 / (2a)$ $s = (20)^2 / (2 \times 5)$ $s = 400 / 10$ s = 40 metres

6. v = 40 m/s, a = 5 m/s² $s = (40)^2 / (2 \times 5)$ $s = 1600 / 10$ s = 160 metres Note: 40 m → 160 m is a 4× increase despite only 2× speed increase.

7. v = 15 m/s, a = 3 m/s² (wet road) $s = (15)^2 / (2 \times 3)$ $s = 225 / 6$ s = 37.5 metres Wet roads require 50% longer stopping distance than dry roads (compare: 15 m/s on dry = 22.5 m).

8. $s = v^2 / (2a)$, where v is velocity and a is deceleration.

9. Kinetic energy ($\frac{1}{2}mv^2$) is proportional to velocity squared; more energy requires more distance to dissipate.

10. It quadruples (4×). E.g., 20 m/s → 40 m/s: 40 m → 160 m.