1. A 2 kg mass is at $x = 0$ and a 6 kg mass at $x = 8$ m. Where is the centre of mass, in metres?

   _____ m

2. What is the SI unit of force?

   ☐ joule

   ☐ watt

   ☐ newton

   ☐ pascal

3. You push a wall with a force of 50 N. With what force does the wall push back on you?

   ☐ 25 N

   ☐ 50 N

   ☐ 0 N – walls do not push

   ☐ 100 N

4. An object has zero net force acting on it. What must be true of its motion?

   ☐ It has constant velocity (possibly zero)

   ☐ It must be speeding up

   ☐ It must be at rest

   ☐ It must be turning

5. A net force of 12 N acts on a 3 kg trolley. What is its acceleration, in $\frac{\text{m}}{\text{s}^2}$?

   _____ m/s^2

6. What is the weight of a 5 kg bag on Earth, where $g = 9.8\ \frac{\text{N}}{\text{kg}}$? Answer in N.

   _____ N

7. Which friction acts on an object that is being pushed but has **not** started to move?

   ☐ no friction at all

   ☐ both, equally

   ☐ static friction

   ☐ kinetic friction

8. A spring with $k = 200\ \frac{\text{N}}{\text{m}}$ is stretched by 0.10 m. What is the spring force, in N?

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9. A ball on a horizontal frictionless table moves in a circle on a horizontal string. The string snaps. Which way does it then move?

   ☐ it stops immediately

   ☐ straight toward the centre

   ☐ straight outward, away from the centre

   ☐ along the tangent, in a straight line

10. The centre of mass must always lie inside the material of the object.

    ☐ True ☐ False

1. **6 m**

   $x_{\text{cm}} = \dfrac{2(0) + 6(8)}{2 + 6} = \dfrac{48}{8} = 6$ m – closer to the heavier mass.

2. **newton**

   Force is measured in **newtons** (N). Joules measure energy, watts power, pascals pressure.

3. 50 **N**

   By the third law the reaction is equal in size: the wall pushes back with 50 N.

4. **It has constant velocity (possibly zero)**

   Zero net force ⇒ zero acceleration ⇒ constant velocity. Rest is the special case where that velocity is zero.

5. **4 m/s^2**

   $a = F_{\text{net}}/m = 12/3 = 4\ \frac{\text{m}}{\text{s}^2}$.

6. **49 N**

   $W = mg = 5 \times 9.8 = 49$ N.

7. **static friction**

   Before sliding, **static** friction acts and grows to match the push, up to $\mu_s N$.

8. **20 N**

   $F = kx = 200 \times 0.10 = 20$ N.

9. **along the tangent, in a straight line**

   With no inward force, inertia carries the ball in a straight line – along the **tangent** where the string broke.

10. **False**

    A ring or boomerang has its centre of mass in empty space. Its location depends on the mass distribution.

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