

4. Mechanics

Starter Quiz · 课前小测

A-Level Mathematics

Name: _____ Score: _____

1. The coefficient of friction is 0.4 and the normal reaction is 100 N. What is the maximum (limiting) friction force, in N?

2. A car starts from rest and accelerates at 2.5 m/s^2 for 4 s. Using $v = u + at$, what is its speed (m/s)?

3. A 2 kg body moving at 3 m/s hits a stationary 1 kg body and they stick together. What is their common speed (m/s)?

4. A resultant force gives a 5 kg mass an acceleration of 2 m/s^2 . What is the force ($F = ma$), in N?

5. What is the kinetic energy of a 2 kg object moving at 3 m/s ($KE = \frac{1}{2}mv^2$), in J?

6. A particle is in equilibrium when the forces on it:
☐ have a vector sum of zero
☐ are all pointing up
☐ are all equal in size
☐ are all friction
7. Momentum is defined as:
☐ mass $\times$ velocity
☐ mass $\times$ acceleration
☐ force $\times$ distance
☐ mass / velocity
8. The horizontal component of a force F at angle θ to the horizontal is:
☐ $F \cos \theta$
☐ $F \sin \theta$
☐ $F \tan \theta$
☐ F / θ

9. On a velocity–time graph, the area under the line gives the:

- ☐ displacement
☐ acceleration
☐ force
☐ mass

10. In a collision, the total momentum of the two bodies is conserved.

- ☐ True ☐ False

1. **40**

Maximum friction = $\mu R = 0.4 \times 100 = 40 \text{ N}$.

2. **10**

$v = 0 + 2.5 \times 4 = 10 \text{ m/s}$.

3. **2**

$2(3) + 1(0) = (2+1)v$, so $6 = 3v$, giving $v = 2 \text{ m/s}$.

4. **10**

$F = ma = 5 \times 2 = 10 \text{ N}$.

5. **9**

$\text{KE} = \frac{1}{2} \times 2 \times 3^2 = \frac{1}{2} \times 2 \times 9 = 9 \text{ J}$.

6. **have a vector sum of zero**

Equilibrium means the forces balance — their vector sum is zero.

7. **mass $\times$ velocity**

Momentum = mass $\times$ velocity, a vector quantity.

8. **$F \cos \theta$**

Horizontal component = $F \cos \theta$; vertical component = $F \sin \theta$.

9. **displacement**

Area = displacement; the gradient gives the acceleration.

10. **True**

Total momentum before equals total momentum after the collision.