Exam workout

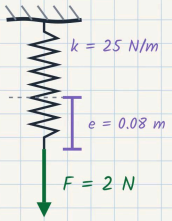
forces

sansara academy
Summary sheet

1 A spring: F = k e

A spring has a spring constant of 25 N/m.
A force stretches it by 8 cm.
What is the force?

Knowns	$k = 25$ N/m, $e = 8$ cm
Convert	8 cm $= 0.08$ m
Equation	$F = k\,e$
Substitute	$F = 25 \times 0.08$
Answer	$F = 2$ N

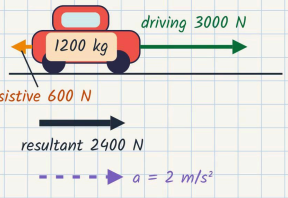


- Five steps for every calculation: **knowns, convert, equation, substitute, answer**.
- **Convert centimetres to metres first**: k = 25 N/m, e = 8 cm = 0.08 m, so F = k e = 25 × 0.08 = **2 N**.

2 Acceleration: graph and F = m a

A car of mass 1200 kg has a driving force of 3000 N and a resistive force of 600 N.
Calculate its acceleration.

$F = 3000 - 600 = 2400$ N
$a = F \div m$
$a = 2400 \div 1200 =$ 2 m/s²



- **Read graph values carefully**: a cyclist going from 4 m/s to 10 m/s in 3 s has Δv = final − initial = 10 − 4 = 6 m/s, so a = 6 ÷ 3 = **2 m/s²**.
- F = m a uses the **resultant force**: 3000 N − 600 N = 2400 N, so a = 2400 ÷ 1200 = **2 m/s²**.

3 An explanation

Model answer

The resultant force on the stone is zero, because the friction is so small. ✓

So its velocity doesn't change, as Newton's First Law says. ✓

2 marks

no force is needed to keep it moving

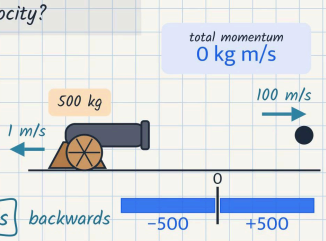


- Constant velocity means the **resultant force is zero** (Newton's First Law).
- No force is needed to keep an object moving; on smooth ice the friction is so small that the velocity doesn't change.

4 Higher: momentum

A 500 kg cannon fires a 5 kg ball at 100 m/s.
Both start at rest.
What is the cannon's recoil velocity?

before: total $p = 0$
after: total $p = 0$
ball: $p = 5 \times 100 = +500$
cannon: $p = -500$
$v = -500 \div 500 =$ −1 m/s backwards



- **Total momentum before = total momentum after.** Both start at rest, so the total is 0 before and after.
- Ball: p = 5 × 100 = +500 kg m/s, so the cannon has −500 kg m/s: v = −500 ÷ 500 = **−1 m/s**, 1 m/s backwards.

Exam tip

Convert units before you substitute, use the resultant force in F = m a, and at terminal velocity the air resistance equals the weight.

Check yourself

1. A skydiver of mass 80 kg falls at terminal velocity. Taking g = 9.8 N/kg, what is the air resistance on her?

Answers: 1. At terminal velocity, air resistance = weight = 80 × 9.8 = 784 N.