

AS Physics 9702

Unit 3 · Dynamics

Original worksheet

Name: _____ Date: _____

Suggested marks: 79. Work through the questions over more than one study session if needed. Use additional paper for extended working and graph paper where requested.

Show equations, substitutions, units and reasoning. Use the constants specified in each question. The questions are original practice, not an official Cambridge examination or mark scheme.

Scope: Cambridge International AS Physics 9702, 2025–2027 learning outcomes. The published 2028–2030 AS scope has been checked separately and is substantively unchanged. Version: 11 October 2026.

U3-Q1 · 6 marks

A 40.0 kg trolley is pushed horizontally with 180 N while resistance is 60 N. (a) Find its acceleration. (b) State how acceleration changes if the mass doubles but both forces remain the same. (c) State Newton's first law and explain what happens when the pushing force becomes 60 N while the trolley is moving.

U3-Q2 · 6 marks

A 60.0 kg passenger stands on a scale in a lift. Take $g = 9.81 \text{ m s}^{-2}$. Find the scale force when acceleration is (a) 1.20 m s^{-2} upward; (b) 1.20 m s^{-2} downward; (c) 9.81 m s^{-2} downward in free fall. Does the passenger's weight change between these cases?

U3-Q3 · 7 marks

A 0.150 kg ball moving horizontally at $+12.0 \text{ m s}^{-1}$ rebounds at -8.00 m s^{-1} . Contact lasts 0.0250 s. (a) Find initial and final momentum, impulse and average horizontal force. (b) If the horizontal force pulse were triangular over the same duration, find its peak magnitude.

U3-Q4 · 6 marks

A book rests on a table. Identify (a) the forces on the book; (b) the Newton's-third-law partner of each force; (c) why the two forces on the book are not themselves a third-law pair. Explain why equal and opposite interaction forces do not prevent a person from walking forwards.

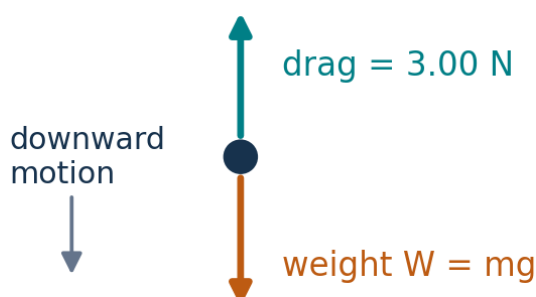
U3-Q5 · 8 marks

An object and its attached parachute have total mass 0.500 kg and fall vertically through still air. The parachute is initially closed. Neglect upthrust (buoyancy). Take $g = 9.81\text{ m s}^{-2}$. (a) Find its downward acceleration when upward drag is 3.00 N . (b) State the drag at terminal speed. (c) Describe the speed-time graph from rest. (d) Explain the initial effect of opening a parachute and the subsequent approach to a new terminal speed.

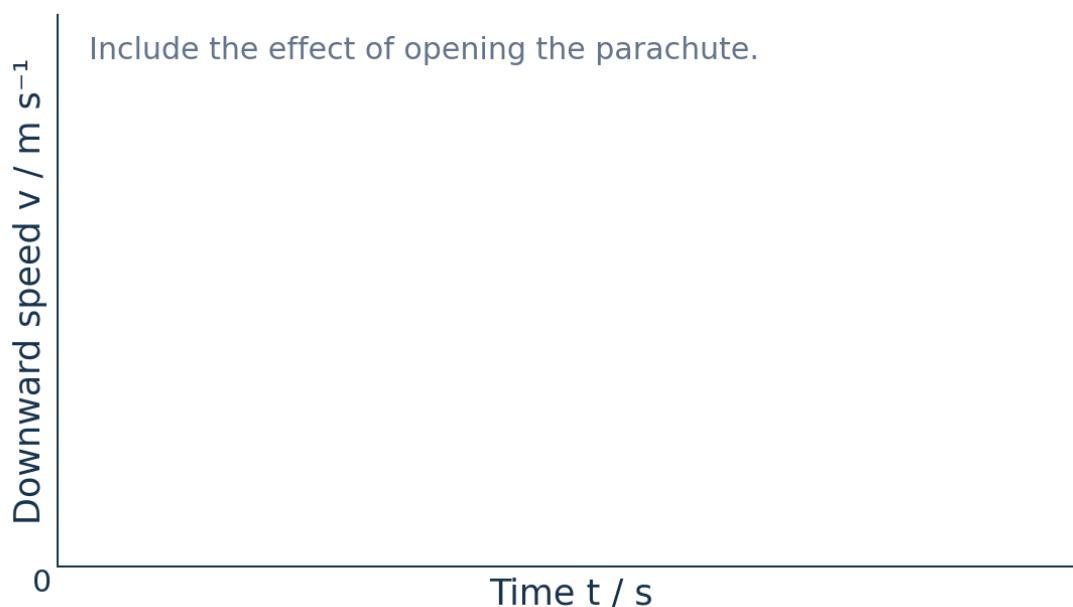
Figure for U3-Q5

Falling object + attached parachute

Total mass = 0.500 kg ; $g = 9.81\text{ m s}^{-2}$



Upthrust neglected. Force arrows are schematic.

Sketch the speed-time graph from rest

U3-Q6 · 5 marks

A 200 kg vehicle moves in a straight line on a horizontal road at constant speed, with driving force 800 N. Its driving force is suddenly increased to 900 N. (a) Find the resistance just before the change and the acceleration immediately after it, assuming resistance has not yet changed. (b) Explain why acceleration subsequently falls if resistance increases with speed.

U3-Q7 · 8 marks

On a low-friction track a 0.600 kg cart moving at $+5.00 \text{ m s}^{-1}$ collides with a 0.400 kg cart moving at -1.00 m s^{-1} . They stick. (a) State the momentum-conservation condition. (b) Find their final velocity. (c) Calculate the kinetic-energy decrease and explain where the energy can go.

U3-Q8 · 9 marks

A 0.200 kg cart moving at $+6.00 \text{ m s}^{-1}$ makes a one-dimensional elastic collision with a stationary 0.300 kg cart. Neglect external impulse. Use momentum conservation and relative speeds to find both final velocities, then verify kinetic-energy conservation.

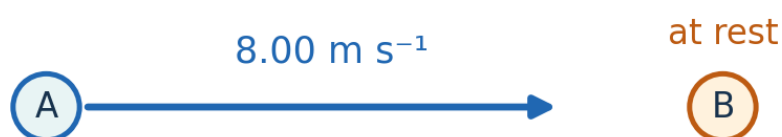
U3-Q9 · 9 marks

On a horizontal low-friction surface, a 1.50 kg object moves east at 4.00 m s^{-1} while a 0.500 kg object moves north at 6.00 m s^{-1} . They collide and remain together. Find the final velocity components, speed and direction, and the kinetic-energy decrease. State which external impulse is assumed negligible.

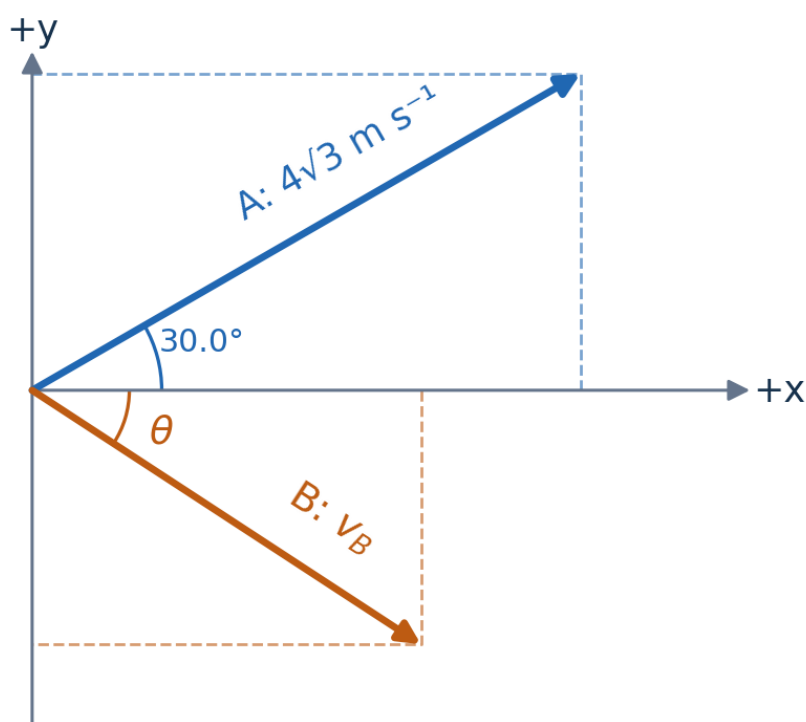
U3-Q10 · 9 marks

A 0.500 kg puck moves at 8.00 m s^{-1} along +x and collides with an identical stationary puck. Afterwards the first puck has speed $4\sqrt{3} \text{ m s}^{-1}$ at $+30.0^\circ$ to x. External horizontal impulse is negligible. Find the second puck's velocity components, speed and direction. Determine whether the collision is elastic.

Figure for U3-Q10

Before the collision

Each puck has mass 0.500 kg.

After the collision

Schematic. Find B's components, speed and direction.

U3-Q11 · 3 marks

Diagnostic multiple choice. A car travels east while slowing down. Which statement must be correct? A: Both velocity and resultant force point west. B: Velocity points east and resultant force points west. C: Resultant force is zero because the car is still moving. D: Acceleration points east because velocity points east. Choose one option and explain why the others fail.

U3-Q12 · 3 marks

Diagnostic multiple choice. Two carts stick together in a brief collision with negligible external impulse. Which statement is correct? A: Momentum and kinetic energy must both be conserved. B: Neither is conserved because the carts deform. C: Total momentum is conserved but kinetic energy may decrease. D: Each cart separately retains its original momentum. Choose one option and explain the distractors.

Use with the full notes

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