Level 2 Physics: practice paper 2026

AS 91171 Demonstrate understanding of mechanics · Vertex Academy practice paper, not an NZQA paper

Attempt ALL the questions. Show ALL working. Write your answers on lined paper, or in the space under each question.

QUESTION ONE

(a) A car on a Christchurch motorway on-ramp speeds up from rest to 27 m s^{-1} in 9.0 s.
Use $a = \Delta v \div t$ and $d = ((v_i + v_f) \div 2) \times t$.
Calculate the car's acceleration and the distance it travels.

(b) A kayaker crossing the Waikato River paddles at 1.5 m s^{-1} straight across, while the current carries the kayak downstream at 2.0 m s^{-1}.
Calculate the kayak's resultant velocity (size and direction).

(c) A ball rolls off the edge of a deck 1.8 m above the lawn, moving horizontally at 4.0 m s^{-1}. Ignore air resistance.
Use g = 9.8 m s^{-2}. Use d = vi t + ½at^2.
Calculate how far from the deck the ball lands, and explain why its horizontal velocity stays the same while its vertical velocity increases.

(d) In a rugby game at Eden Park a player kicks the ball from the ground at 18 m s^{-1}, 35° above the horizontal, towards the posts 22 m away. The crossbar is 3.0 m above the ground. Ignore air resistance.
Use g = 9.8 m s^{-2}. Use d = vi t + ½at^2 and vf = vi + at.
Show whether the ball clears the crossbar, and whether it is still rising or already falling as it reaches the posts.

QUESTION TWO

(a) A 25 kg child sits on a seesaw in a Dunedin playground, 1.2 m from the pivot.
Use $g = 9.8\ \text{m s}^{-2}$. Use $\tau = Fd$ and $F = mg$.
Calculate the torque the child's weight produces about the pivot.

(b) A car drives around a roundabout of radius 20 m at a steady $10\ \text{m s}^{-1}$.
Use $a = v^2 \div r$.
Calculate the car's acceleration and state its direction.

(c) A uniform plank 4.0 m long with a mass of 20 kg rests on two trestles, A and B, one at each end. A 70 kg painter stands on the plank 1.0 m from A.
Use $g = 9.8\ \text{m s}^{-2}$. Use $\tau = Fd$.
Calculate the support force from each trestle.

(d) A 1200 kg car drives around a flat roundabout of radius 20 m. The tyres can give a sideways friction force of at most 9000 N.

Use $F = mv^2 \div r$.

Explain what force keeps the car moving in a circle and calculate the friction force needed at 10 m s^{-1}.

Calculate the greatest speed at which the car can go around, and explain what happens if it goes faster.

QUESTION THREE

(a) A spring on a trampoline stretches 0.050 m when a force of 400 N pulls on it.
Use $F = kx$.
Calculate the spring constant.

(b) A trampoline spring with $k = 8000\ \text{N m}^{-1}$ is stretched 0.080 m when a child lands.
Use $E_p = \frac{1}{2}kx^2$.
Calculate the elastic potential energy stored in the spring.

(c) In a rugby game, a 95 kg player running east at $6.0\ \text{m s}^{-1}$ collides head-on with an 80 kg player running west at $4.0\ \text{m s}^{-1}$. They hold on to each other and move off together.
Use $p = mv$.
Calculate their velocity just after the collision, and explain why momentum is conserved in the collision.

(d) The two rugby players from part (c) (95 kg at 6.0 m s^{-1} east and 80 kg at 4.0 m s^{-1} west) move off together at 1.43 m s^{-1} east. The collision lasts 0.40 s.

Use $E_k = \frac{1}{2}mv^2$, $p = mv$ and $F = \Delta p \div t$.

Show that the collision is inelastic and explain where the kinetic energy has gone. Calculate the average force on the 80 kg player during the collision.

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