Dynamics: Newton's Laws and Momentum

Mechanics · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$F = \Delta p / \Delta t \quad p = mv \quad F\Delta t = \Delta(mv)$

Questions

Show your working in the space under each question.

1. A 3.0 kg trolley at 4.0 m s^{-1} collides with a 1.0 kg trolley at rest and they join. Find the common speed and the kinetic energy lost.

2. A 0.16 kg ball travelling at 30 m s^{-1} is hit straight back at 20 m s^{-1}. The contact lasts 4.0 ms. Find the average force on the ball.

3. A lift of mass 500 kg accelerates upward at 1.5 m s^{-2}. Find the tension in its cable.

4. A rocket ejects 2.0 kg of gas each second at 500 m s^{-1}. Find the thrust.

Step-by-step answers

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1. v = 12/4.0 = **3.0 m s⁻¹**. KE before = 24 J, after = 18 J: **6 J lost**.

2. 1. Take the final direction as positive: u = −30, v = +20 m s⁻¹.
2. Δp = 0.16 × (20 − (−30)) = **8.0 kg m s⁻¹**.
3. F = Δp/Δt = 8.0/0.0040 = **2000 N**.
Answer: 2.0 kN

3. T − mg = ma, so T = 500(9.81 + 1.5) = **5660 N**.

4. F = Δp/Δt = 2.0 × 500 = **1000 N**.