

# Essay Exam 3, Jay Patel, Classical Physics1 OL01

## Professor Van, Huett

Classical Physics I V. Huett  
SU2015 Exam 3

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Essay Questions (10 points each). Show your work, partial-credit will be given. Circle your answer.

1) A machine gun, of mass 39.4 kg, fires 11.4-gram bullets, with a velocity of 764 m/s coming out of the barrel of the gun, at the rate of 399 rounds per minute. What is the average force exerted on the gun mount?

$$\begin{aligned} F &= ma = m(v-u)/t \\ &= (39.4 \text{ kg})(764 - 0) / (60 \text{ s}) \\ &= 502 \text{ N} \end{aligned}$$

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- 2) A child (48 kg) stands on the edge of a stationary merry-go-round (uniform disk of radius 1.2 m and mass 50 kg). The child jumps off at 1.0 m/s with respect to the ground in the direction tangential to the edge. Find the angular speed of the merry-go-round after the jump. Assume there is no friction on the axle of the merry-go-round.

$$I = 50 \times \frac{1}{2} \times (1.2)^2$$
$$= 36 \text{ kg} \cdot \text{m}^2$$

∴ conservation of angular momentum

$$36 \times \omega = 48 \times 1 \times 1.2$$

$$\omega = \frac{48 \times 1 \times 1.2}{36}$$

$$\omega = 1.6 \text{ rad/s}$$

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- 3) A uniform 7.9-m plank weighing 130 N lies on a platform with 3.5 m jutting off the platform. How far out on the plank from the edge of the platform can a 31-N dog walk without tipping the plank?

$$7.9/2 = 3.95$$

So centre of plank is 3.95 from outer end

$$\text{which is } 3.95 - 3.5 = 0.45 \text{ inside the edge of the platform}$$

So for equilibrium

$$130(0.45) = 31x$$

$$x = 1.89 \text{ out from edge}$$