

XPX103

PUBLIC EXAMINATION

Honour School of Physics

Generic Physics

Friday, 10 February 2006, 2.30 pm – 4.10 pm

*Answer **the question** in Section A. That's it.*

A list of physical constants and conversion factors accompanies this paper.

The numbers in the margin indicate the weight which the Examiners expect to assign to each part of the question.

Do NOT turn over until told that you may do so.

Section A

1. A physicist walks into a bar.

The physicist is moving with non-relativistic velocity \mathbf{u} before the collision and the bar is at rest on a smooth, infinite, plane horizontal floor. He strikes the bar perpendicular to its length, a distance x from its centre. Considering the physicist as a point particle of mass m and the bar, beer taps and any drunkards sat at it as a uniform, inextensible rod of total mass M and length l , evaluate the change in the linear and angular momentum of the bar as a result of this joke. Air resistance, friction, gravity, rotation of the Earth and other real-world factors can be neglected.

Given that the physicist has a pain threshold of 15Pa, the bar has mass 800kg, the physicist has mass 70kg, his speed before the collision is 4mph, the time of contact is 0.1s and his shin has area 50cm², does he say “ouch”?

(The moment of inertia of a bar of length l about an axis through the centre of mass and perpendicular to the rod is $\frac{1}{12}Ml^2$.)