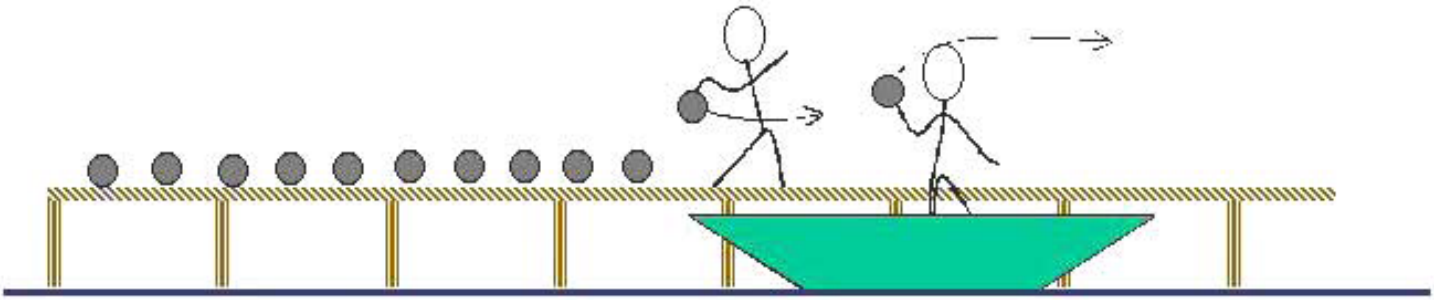
Chapter 1, Question 2:
Rock(-Breathing) Propulsion

A person on a dock throws rocks to a person in a boat who in turn throws them into the water. What is the force (F) on the boat?

R = throwing rate (rocks/s)
m_b = mass of boat and everything in it (kg)
m_r = mass of one rock (kg)
u_{in} = velocity of rock in, relative to boat (m/s)
u_{out} = velocity of rock out, relative to boat (m/s)
u_b = velocity of boat (m/s)



1) $F = Rm_r(u_{out}-u_{in})$
2) $F = R(m_r+m_b)(u_{out}-u_{in})$
3) $F = R(m_r+m_b)(u_b-u_{out})$
4) $F = Rm_r(u_b-u_{out}-u_{in})$
5) None of the above
6) I don't know

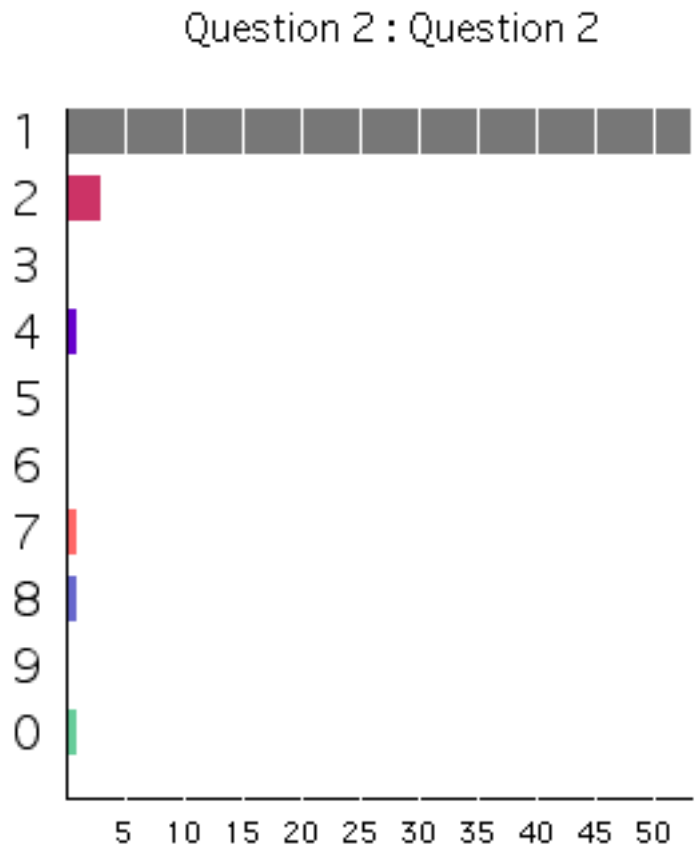
L.O. A

Chapter 1, Question 2 Answer:

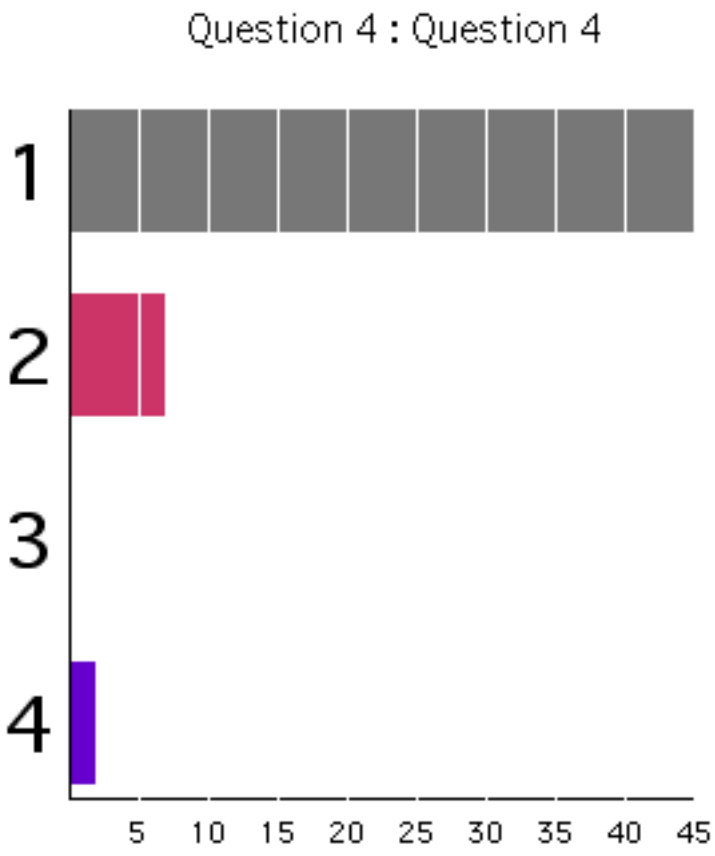
The correct answer is 1) $F=Rm_r(u_{out}-u_{in})$.

The force is equal to the time rate of change of momentum. The impulse is provided by the difference between a mass flow rate of rocks (Rm_r) which are taken in with a velocity with respect to the boat of u_{in}, and a mass flow rate of rocks (Rm_r) which are ejected with a velocity with respect to the boat of u_{out}.

Class response (2004):



Class response (2003):



Class response (2001):

Question 2 : Question 2