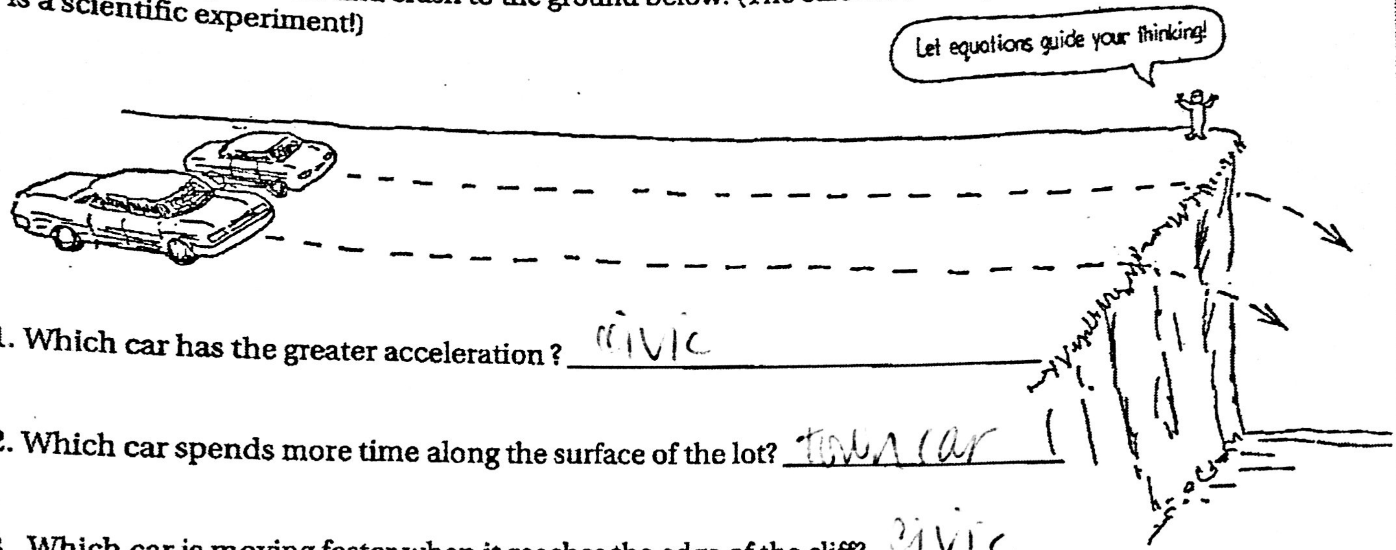
...rgy and Momentum

A Honda Civic and a Lincoln Town Car are initially at rest on a horizontal parking lot at the edge of a steep cliff. For simplicity, we assume that the Town Car has twice as much mass as the Civic. Equal constant forces are applied to each car and they accelerate across equal distances (we ignore the effects of friction). When they reach the far end of the lot the force is suddenly removed, whereupon they sail through the air and crash to the ground below. (The cars are beat up to begin with, and this is a scientific experiment!)



1. Which car has the greater acceleration? civic

2. Which car spends more time along the surface of the lot? Town car

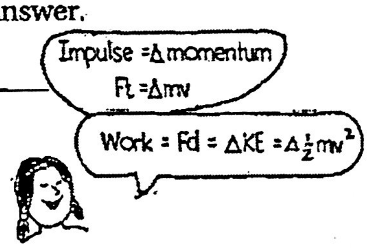
3. Which car is moving faster when it reaches the edge of the cliff? civic

4. Which car has the larger impulse imparted to it by the applied force? Defend your answer.

Town car: longer time

5. Which car has the greater momentum at the edge of the cliff? Defend your answer.

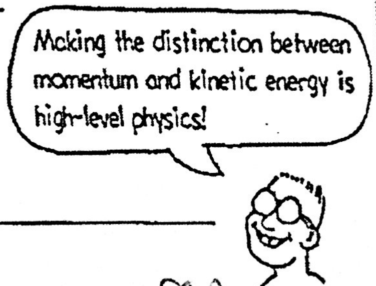
Town car. longer impulse



6. Which car has the greater work done on it by the applied force? Defend your answer in terms of the distance traveled.

same

7. Which car has the greater kinetic energy at the edge of the cliff? Does your answer follow from your explanation of 6? Does it contradict your answer to 4? Why or why not?



same

8. Which car spends more time in the air, from the edge of the cliff to the ground below? same

9. Which car lands farthest horizontally from the edge of the cliff onto the ground below? Civic

10. Challenge: Suppose the slower car crashes a horizontal distance of 10 m from the ledge. Then at what horizontal distance does the faster car hit?

14.1m

$\frac{1}{2} m v_{HC}^2 =$

$\frac{1}{2} m_{HC} v_{HC}^2 = m_{HC} v_{TC}^2$

Conceptual PHYSICS

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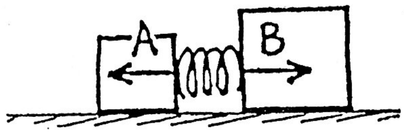
CONCEPTUAL Physics PRACTICE PAGE

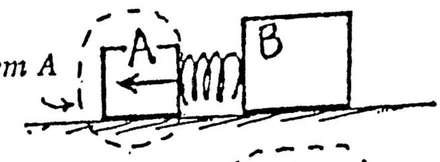
Chapter 5 Momentum
Systems



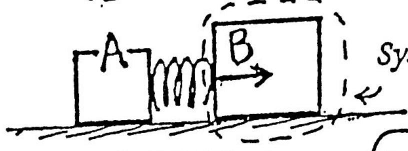
1. When the compressed spring is released, Blocks A and B will slide apart. There are 3 systems to consider here, indicated by the closed dashed lines below — System A, System B, and System A+B. Ignore the vertical forces of gravity and the support force of the table.

a. Does an external force act on System A? (yes) (no)
Will the momentum of System A change? (yes) (no)

System A



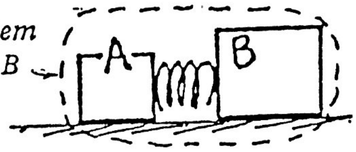
b. Does an external force act on System B? (yes) (no)
Will the momentum of System B change? (yes) (no)



System B

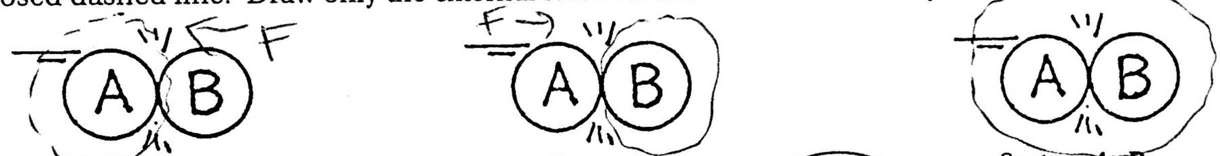
c. Does an external force act on System A+B? (yes) (no)
Will the momentum of System A+B change? (yes) (no)

System A+B



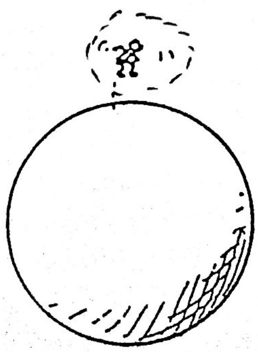
Note that external forces on System A and System B are internal to System A+B, so they cancel!

2. Billiard ball A collides with billiard ball B at rest. Isolate each system with a closed dashed line. Draw only the external force vectors that act on each system.



System A *System B* *System A+B*

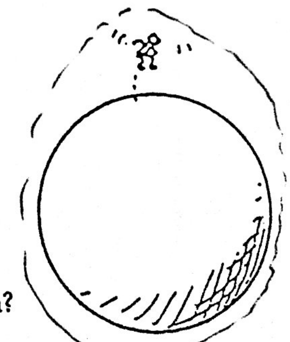
a. Upon collision, the momentum of System A (increases) (decreases) (remains unchanged).
b. Upon collision, the momentum of System B (increases) (decreases) (remains unchanged).
c. Upon collision, the momentum of System A+B (increases) (decreases) (remains unchanged).



3. A girl jumps upward. In the sketch to the left, draw a closed dashed line to indicate the system of the girl.

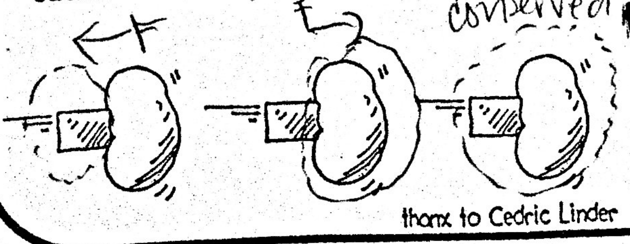
a. Is there an external force acting on her? (yes) (no)
Does her momentum change? (yes) (no)
Is the girl's momentum conserved? (yes) (no)

b. In the sketch to the right, draw a closed dashed line to indicate the system [girl + earth]. Is there an external force due to the interaction between the girl and the earth that acts on the system? (yes) (no)
Is the momentum of the system conserved? (yes) (no)



4. A block strikes a blob of jelly. Isolate 3 systems with a closed dashed line and show the external force on each. In which system is momentum conserved?

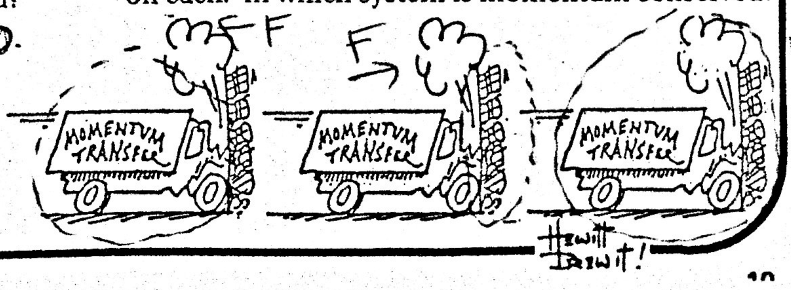
conserved P.



thanx to Cedric Linder

5. A truck crashes into a wall. Isolate 3 systems with a closed dashed line and show the the external force on each. In which system is momentum conserved?

P conserved



Hewitt Drew it!