Description: Click Play to watch the video below. Answer the ungraded questions in the video and the graded follow-up questions at right. (a) Three blocks are at rest on a smooth, horizontal table. You push on block A (m = 1.50 kg) to the right with a horizontal...

Constants | Periodic Table

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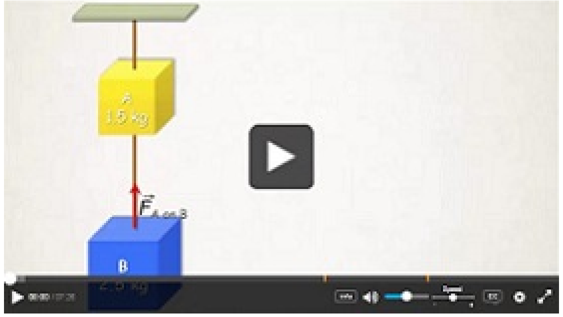

Part A

Three blocks are at rest on a smooth, horizontal table. You push on block A (m = 1.50 kg) to the right with a horizontal force of F_{push}. As a result, block A pushes on block B (m = 2.50 kg), block B pushes on block C (m = 1.20 kg), and the system of blocks moves to the right with an acceleration of 1.12 m/s^2. What is the magnitude of the force that block B exerts on block C?

ANSWER:

- 1.34 N
- 1.65 N
- 5.82 N
- 7.45 N
- 2.75 N

A free-body diagram of the forces acting on block C will show the force that block B exerts on C ($F_{\text{B on C}}$) pointing to the right, and no other horizontal forces. Therefore, this force is equal to the mass of block C times its acceleration: $F_{\text{B on C}} = m_{\text{C}}\,a$. Solving for the force that B exerts on C gives: $F_{\text{B on C}} = (1.20\ \text{kg})(1.12\ \text{m/s}^2) = 1.34\ \text{N}$.

Also, according to Newton's Third Law, the force that block B exerts on C and the force that block C exerts on B are equal in magnitude and opposite in direction. That is: $F_{\text{C on B}} = 1.34\ \text{N}$.

Part B

In the scenario described above, what is the magnitude of the force that block A exerts on block B?

ANSWER:

- 4.14 N
- 1.34 N
- 6.90 N
- 5.82 N
- 2.80 N

A free-body diagram of the forces acting on block B will show the force block A exerts on B ($F_{\text{A on B}}$) pointing to the right and the force that block C exerts on B ($F_{\text{C on B}}$) pointing to the left. The vector sum of these forces is $F_{\text{A on B}} - F_{\text{C on B}}$ and is equal to the mass of block B times its acceleration: $F_{\text{A on B}} - F_{\text{C on B}} = m_{\text{B}}\,a$. Solving for the force that A exerts on B gives $F_{\text{A on B}} = F_{\text{C on B}} + m_{\text{B}}\,a = 1.34\ \text{N} + (2.50\ \text{kg})(1.12\ \text{m/s}^2) = 4.14\ \text{N}$.

Also, according to Newton's Third Law, the force that block A exerts on B and the force that block B exerts on A are equal in magnitude and opposite in direction. That is: $F_{\text{B on A}} = 4.14\ \text{N}$.

Part C

In the scenario described above, what is the magnitude of the force F_{push}?

ANSWER:

- 4.14 N
- 5.82 N
- 2.75 N
- 1.32 N
- 7.12 N

A free-body diagram of the forces acting on block A will show the applied force of F_{push} pointing to the right and the force that block B exerts on A ($F_{\text{B on A}}$) pointing to the left. The vector sum of these forces is $F_{\text{push}} - F_{\text{B on A}}$ and is equal to the mass of block A times its acceleration: $F_{\text{push}} - F_{\text{B on A}} = m_{\text{A}}\,a$. Solving for the applied force gives: $F_{\text{push}} = F_{\text{B on A}} + m_{\text{A}}\,a = 4.14\ \text{N}\ + (1.50\ \text{kg})(1.12\ \text{m/s}^2) = 5.82\ \text{N}$.

As it turns out, you also could have arrived at this value by applying Newton's 2nd law to the block system as a whole, since: $F_{\text{net}} = (m_{\text{A}} +\ m_{\text{A}}\ +\ m_{\text{A}})\,a = (5.20\ \text{kg})(1.12\ \text{m/s}^2) = 5.82\ \text{N}$.