

Force Concept Inventory

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Every student begins physics with a well-established system of commonsense beliefs about how the physical world works derived from years of personal experience. Over the last decade, physics education research has established that these beliefs play a dominant role in introductory physics. Instruction that does not take them into account is almost totally ineffective, at least for the majority of students.

Specifically, it has been established that¹ (1) commonsense beliefs about motion and force are incompatible with Newtonian concepts in most respects, (2) conventional physics instruction produces little change in these beliefs, and (3) this result is independent of the instructor and the mode of instruction. The implications could not be more serious. Since the students have evidently not learned the most basic Newtonian concepts, they must have failed to comprehend most of the material in the course. They have been forced to cope with the subject by rote memorization of isolated fragments and by carrying out meaningless tasks. No wonder so many are repelled! The few who are successful have become so by their own devices, the course and the teacher having supplied only the opportunity and perhaps inspiration.

Table I. Newtonian Concepts in the Inventory.

	Inventory Item
0. Kinematics	
Velocity discriminated from position	20E
Acceleration discriminated from velocity	21D
Constant acceleration entails parabolic orbit	23D, 24E
changing speed	25B
Vector addition of velocities	(7E)
1. First Law	
with no force	4B, (6B), 10B
velocity direction constant	26B
speed constant	8A, 27 A
with cancelling forces	18B, 28C
2. Second Law	
Impulsive force	(6B), (7E)
Constant force implies constant acceleration	24E, 25B
3. Third Law	
for impulsive forces	2E, 11E
for continuous forces	13A, 14A
4. Superposition Principle	
Vector sum	19B
Cancelling forces	(9D), 18B, 28C
5. Kinds of Force	
5S. Solid contact	
passive	(9D), (12 B,D)
Impulsive	15C
Friction opposes motion	29C
5F. Fluid contact	
Air resistance	22D
buoyant (air pressure)	12D
5G. Gravitation	
	5E, 9D, (12B,D),
	17C, 18B, 22D
acceleration independent of weight	1C, 3A
parabolic trajectory	16B, 23D

Force Concept Inventory Test Answer Key

Patrick Vollmar



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