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ACCURACY REPORT

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p 26 Discovery Lab
See the later discussion of the 'Scientific Method' and hypotheses.

RESPONSE: The above comment is not an inaccuracy claim. The reviewer's concerns about the treatment of the Scientific Method and hypotheses are addressed later in this document.

p 94 Connect to Chemistry

Biodegradable plastics contain substances such as starch that can be broken down by microbes. The sentence makes it seem as though starch is a microbe.

RESPONSE: The clause that can be broken down by microbes is functioning as an adjective that modifies substances and is essential to clarifying the kinds of substances that are being referred to. So, starch is an example of "a substance that can be broken down by microbes," not simply an example of "a substance."

p 156 in High Tides and Low Tides

How high tides get and how often they occur depend on the position of the moon as it revolves around the earth. The moon, strictly speaking, DOES NOT REVOLVE AROUND THE EARTH but instead REVOLVES AROUND THE SUN, the body which provides the dominant force on the moon by more than a factor of 2! And the statement ignores the considerable influence that the Sun has on tide heights - as per "spring tides" and "neap tides."

RESPONSE: The passage in question is on pages 158–159. The reviewer's concern is a matter of semantics. An object such as the moon can revolve around the Earth, sun, and the galactic core all at once. When discussing tidal forces, the moon/Earth system produces the dominant effect. Spring and neap tides are discussed on the following page.

p161 in Answers to SECTION REVIEWS

The answer to question #1 is WRONG. There is almost always a delay in the "establishment of port" - the time of high tide. One reason is tidal friction between the oceans and ocean bottom, which carries the high tide longitude to the East of the sub-lunar point.

RESPONSE: The reviewer is correct in stating that there is a lag between the tide and the positions of the moon and sun. The question is awkwardly worded and in the printing made available for classroom use the question will be changed to the following: "How does the position of the moon relate to the position of high tides?" The answer can be changed to "High tides occur on the side of the Earth facing the moon, and on the side of the Earth opposite the moon."

p 163 Step 10 - 12 in the laboratory

Pulling out the layer of plastic wrap between the layers WITHOUT MIXING the layers is exceedingly difficult. I have been successful with two juice jars, one inverted atop the other with an index card separating them, but this requires care also.

RESPONSE: All labs in the program have been reviewed and classroom tested by teachers. In response to the reviewer's comment, these steps were tested by HRW staff. The plastic wrap was easily removed without significantly disturbing the layers of water and the lab was successful.

p 169F re: Greenhouse Effect

Carbon Dioxide, Methane and water vapor are greenhouse gases. Chlorofluorocarbons are NOT to any appreciable degree. CFCs are "bad" because they destroy ozone high in the atmosphere - way above the layers, which are involved in the Greenhouse Effect. And a CFC molecule cannot absorb 10,000 times the energy removed by a carbon dioxide at one time. a CFC molecule will be dissociated by a SINGLE UV photon and the released Cl and the chlorine atom is not consumed in the reactions which create oxygen from ozone. It is the persistence of the CFCs that is the problem. In order to "save" the ozone layer, CFCs were banned by the Montreal Convention. In so doing, many industrial nations turned to 'ozone-safe' hydrofluorocarbons and perfluorocarbons which ARE greenhouse gases with a long atmospheric lifetime.

RESPONSE: EIA, the Energy Information Administration which provides the official energy statistics for the U.S. Government, classifies CFCs as greenhouse gases. In the printing made available for classroom use the reference to CFCs being able to absorb 10,000 times more energy than carbon dioxide will be deleted.

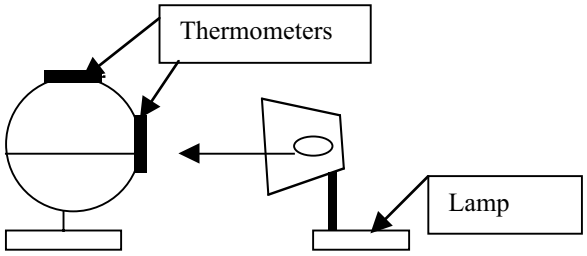
p 171 Activity

In trying to imagine the setup here, I first get that the bulb of the equator thermometer is in its own shadow if the bulb rests on the globe; if the thermometer 'sticks up,' then it is probably about 20 cm closer to the lamp. No wonder its temperature is higher! Probably the experimenter reaches the "right answer" for the wrong reason! And I can see the polar thermometer being parallel to the equatorial on so that it is further from the lamp by the combined distance of the radius of the globe and the length of one thermometer. No wonder that the polar thermometer reads less - IN SPITE OF THE FACT THAT THE PROJECTED CROSS SECTION OF THE THERMOMTER toward the lamp is the same for both.

Perhaps the authors mean that the equatorial thermometer is placed on the globe surface with the axis of the globe parallel to that of the thermometer and the polar thermometer is arranged so that the end of the bulb points to the lamp. The same objection still applies - the distances from the source of heat energy are different. In the case of the earth-sun system, the extra 6400 km - the radius of the earth - is insignificant compared to the earth-sun separation 150 million km. But with this arrangement one gets the projected areas effect correct. Who's to know what was really meant without a picture.

In any case, this experiment/activity tests the inverse square law more than it does the concept of solar insolation. The idea could be advanced as simply as placing 2 pieces of paper beneath a lamp, one sheet at an angle and the other flat. After a short period, the flat sheet will have a higher temperature compared to the inclined sheet.

RESPONSE: The following diagram, although crude, shows the set up for this activity. When using a globe, the thermometer on the equator would be parallel, not perpendicular to the Earth's axis. Using the globe as the visual aid helps students relate this concept to the real world.



p 188 Diagrams and accompanying text

Presently the earth is closer to the sun in winter and more distant in summer [FACT]. According to the diagram the earth will be more distant at both the summer and winter seasons so BOTH will be colder.

RESPONSE: The diagram is meant to show the difference between a circular and an elliptical orbit. When the Earth travels in a more elliptical orbit, the range of distance between the Earth and the sun is greater than the range of distance that is exhibited when the Earth travels in a circular orbit. Whether the seasons are relatively warmer or colder depends on where the Earth is in its orbit and which hemisphere one is considering. The effect that increased eccentricity has on the seasons is to make them more pronounced in one hemisphere and less pronounced in the other hemisphere at a given point in Earth's orbit. In the printing made available for classroom use the label in Figure 27 will be changed to read: "Over a period of 100,000 years, the Earth's orbit slowly changes from a more circular shape to a more elliptical shape. When the orbit is more elliptical, the contrast between seasons is greater in one hemisphere and less in the other hemisphere. When the orbit is more circular, there is not as much seasonal change."

p 199E At the end of the Orbit of Comets

The perturbation of a passing body is as likely to eject permanently an object from the Oort Cloud as it is to alter the orbit into one which carries the comet toward the inner part of the solar system wherein it may be captured OR ejected by interactions with the gas giants, especially Jupiter.

RESPONSE: The text is accurate, although it may not contain all of the information presented by the reviewer.

p 201 Strange Gravity

Pedagogically, the order is nonproductive.

1) Start with two flat pieces released from the same height - they flutter to the floor slowly

2) Crumple one into a ball. Drop ball and sheet; ball lands quickly with sheet fluttering down.

3) Place sheet on book. Drop ball and book and see that sheet falls as quickly now as ball [because the retarding force of aerodynamic drag has been eliminated].

RESPONSE: The activity is accurate. One of the points of this activity is to show the effects of air resistance.

p 209 Arrows in illustration

In almost every scenario I have seen the LENGTH of the arrow is used to indicate the magnitude of the vector quantity. Exactly the opposite is done here. To change both the length and the width is to send a confused message!

RESPONSE: The arrows in the illustration are not intended to represent vector quantities. Such inferences would not be made by the student. The middle school science student has no knowledge of vector quantities and this concept is beyond the scope of most middle school curricula.

p 227 Critical thinking #23

The difference in "gravity" is insignificant. Perhaps the authors think that gravity is near zero on orbit. A quick calculation will show that gravity on orbit is not even 10% smaller than on the surface of the earth. The circular orbit speed is about 70% of the escape speed, however, and THAT IS THE REASON.

RESPONSE: The reviewer is correct. While Earth's gravity is less at the location of an orbiting space station, it is not significantly so. In the printing made available for classroom use the answer in the Teacher's Edition will be revised to note the benefits of less air resistance and in-orbit starting velocity.

p 296 1) MOTIVATE Demonstration

In the rocket equation the authors sort of get it right - gas expansion or pressure is not what propels a rocket. After all, the latest NSA rocket engine, the ion drive, has proven to be so successful and it most certainly does not depend on pressure in any way.

RESPONSE: The discussion of gas pressure and rocket propulsion is consistent with the description presented in the National Aeronautics and Space Administration (NASA) publication Rockets: A Teacher's Guide with Activities in Science, Mathematics, and Technology (EG-1999-06-108-HQ) that can be found at: http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/Rockets/Rockets.pdf

Similar material on rocket principles can be found at: http://www.grc.nasa.gov/WWW/K-12/TRC/Rockets/rocket_principles.html

p 298 How Rockets Work

See comments for page 296. The entire middle block of text with the blue heading Pressure is incorrect.

RESPONSE: See response to p. 296.

p 316 Making Models Lab

This MIGHT be a worthwhile activity to model the arm of the shuttle if one had pneumatics.

RESPONSE: The activity is accurate. The student is making a model to represent a pneumatic system. The nature of a model is that it is not an exact representation.

p 318 Skills Check Math Concepts

The "rocket equation" ignores the important term, weight of the rocket. This 1000 kg rocket [wt force is 10,000 N] can throw out 100 kg every sec with an exhaust velocity of 50 m/s. The rocket thrust will be 5,000 N and the rocket won't budge! So . . . what has been ignored is that is is fuel rate [kg/s] as well as mass of rocket and exhaust which leads to A CHANGE IN VELOCITY. The velocity will CONTINUE to increase so long as the thrust exceeds the weight force.

RESPONSE: This activity is designed to check student use of the conservation of momentum equation related to the action-reaction process of rocket motion. It does not imply the rocket is standing on a launch pad nor is it concerned with changes in velocity (acceleration). Discussion regarding momentum, recoil, and this equation can be found at:
http://www-istp.gsfc.nasa.gov/stargaze/Smoment.htm

p 333 Electrical Energy

Electrical energy is not only from moving charges; there is also ELECTRICAL ENERGY FROM STATIC CONFIGURATIONS. One example is a charged capacitor, which has energy by virtue of the charges on the plates, even though the charges are not moving.

RESPONSE: The reviewer is referring to electrical potential energy (Academic Press Dictionary of Science and Technology) which we do not cover in detail at this level, other than to introduce students to potential forms of energy on pages 330–331. The definition used for electrical energy is a common and accepted definition.

p 417 Electricity from Magnetism

Here the hypothesis is very plain: Faraday's Law. This is just a verification of that law.

RESPONSE: The text does not provide Faraday's Law as the answer so the use of "hypothesis" is consistent with the text's definition.

p 475 Part C: Interference Procedure #8

I asked our resident sound physicist about having a tuning fork in each ear. His answer was that he had heard that it was possible to hear a "beat" but that having one fork in each ear was a complex neurophysiological effect and is not the true phenomena of BEATS that one obtains when the interference is in the air where each ear can hear BOTH forks. As described this is a 'brain processing' results. It is really more desirable to hold both forks together and listen to BOTH forks with both ears.

RESPONSE: We will evaluate this lab further. In the printing made available for classroom use the necessary changes will be made to ensure that the procedure matches the photograph and that the phenomenon is demonstrated.

p 500 Figure 21

A careful tracing of the pattern shows that the maxima/minima on the right hand strip do not coincide with the constructive/destructive interference pattern of the waves to the right of the double slit. It is very deceiving when the parts of a figure cannot be correlated properly.

RESPONSE: Although this diagram may not be absolutely precise from the standpoint of tracing overlays, it does however represent the concept at the level of the middle school science student. Similar representations of Young's double slit experiment can be found on the web at:
http://www.phys.virginia.edu/classes/usem/sciimg/Introduction/Introduction.htm

p 515 Step #2 in the Activity

There is NO WAY to place the virtual image given the opaque mirror. This can be accomplished with a semi-transparent mirror OR a careful, high-stakes drawing. There is nothing CONVINCING that what you see in the mirror is the virtual image BEHIND the mirror. This is a lovely experiment when done properly with a semi-transparent mirror.

RESPONSE: The student is not placing a virtual image. The student is making an observation. The idea of a virtual image is not covered anywhere in this activity. The reviewer is making an inference about the content that the student would not make.

p 518 Figure 4 and Figure 5

The electric current [in step1 of both figures] in the electrode does not cause electrons to be emitted; these come because of the large potential difference.

RESPONSE: The starting mechanisms in fluorescent tubes are fairly complex. There are two main systems in use today. The system illustrated in Figure 4 and 5 is a Rapid-Start fixture. In a Rapid-Start fixture, an electric current in the electrode heats the filaments which are coated with a substance that causes electrons to be released.

Electrons then travel between the electrodes at either end of the tube. The system the reviewer is referring to is an Instant-Start fixture that uses the potential difference between electrodes to strike an arc through the tube. The illustrations are accurate as presented.

p 553 The Models . . .

In fact, if you rotate EITHER MODEL the string attached piece of cardboard will separate from the 'earth' disk which, I gather, is meant to simulate tides. The more important question might be what will be the effect when the string is stapled to other positions around the circumference of the 'earth.' And the suggestion that the water is PUSHED out [intro on p 552] is to move tantalizingly close to centrifugal force WHICH WE ALL KNOW IS NON-EXISTENT.

RESPONSE: The reviewer is making an inference about information, questions, or procedural steps that are not in the activity.

p586 Scientific Methods in Action.

Throughout the text, the activities start with 1) Ask a question, 2) Form a 'hypothesis' about the answer to your question 3) make an observation, etc. They should understand that for a scientist, the HYPOTHESIS is a statement that accounts for the regularities that have already been observed in numerous experiments. In this sense it is a tentative law or set of rules, the validity of which can be tested in additional experiments. That is the reason the step #2 is so poorly stated. The 'if' . . . . 'then' . . . construction IS correct; but to the authors the 'if' part is a condition whereas for a scientist, the 'if' part is the hypothesis.

RESPONSE: The introduction to the information for the scientific methods on page 586 makes it clear that the authors are not presenting an exact process used by scientists. The ideas of observation, experimentation, and utilizing data to support conclusions are appropriately covered. The examples and coverage are age appropriate.

The experiments would be improved greatly if each one had - at the beginning - a clear statement of the concept take was involved in the activity.

RESPONSE: This suggestion will be considered for future editions.

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p 325 E The Water Cycle

This entire section is WRONG. When the earth was created from the protoplanetary nebula, the temperature was too high and the mass of the protoearth too

small to retain any hydrogen gas. The earth was certainly born as a bare rock. As a result of tectonic activity and collisions during its early age, the earth evolved a reducing atmosphere which is devoid of oxygen. Liquid water cannot have come until 1) there is a layer to protect the water from solar UV radiation which will immediately dissociate it into oxygen and hydrogen which escapes, and 2) the temperature must be high enough for liquid water to exist on the surface [ie, greenhouse effect operative]. Whether the water came as a result of outgassing from the primitive material or whether it came as a result of bombardment [comets??] is subject to debate by astronomers. The delay is more like a billion years [which is a thousand million!].

RESPONSE: The reviewer has correctly pointed out some flaws in this background material. In the printing made available for classroom use, this material will be replaced with additional information on transpiration and the water cycle.

p 330 Quick Lab

When the jar is close to the flame, soot will be deposited. When the candle is further from the walls of the jar, water is deposited BUT THE WATER DOES NOT COME FROM THE AIR; This water comes from the combustion of the hydrocarbon that is the wax of the candle; the products of the combustion are carbon dioxide and water.

RESPONSE: Two things happen to cause water to condense inside the jar. 1) the water content in the air is increased due to the combustion process. 2) the temperature of the air in the jar is increased relative to the jar itself, so that condensation occurs on the sides of the jar. The existing answer is not incorrect—the water found on the sides of the jar does come from the air. However, what is not stated is that the air is enriched with water due to the combustion process. This information will be added to the printing made available for classroom use.

p 388 Why Air Moves

The more important aspect of wind speed is not pressure difference but PRESSURE GRADIENT - the change in air pressure per 100 km distance, for example.

RESPONSE: Students at the middle school level are not familiar with the concept of a pressure gradient and it is not within the scope of most middle school curricula. The description of wind resulting from pressure differences is sufficient to communicate the concept.

p 400 Under Pressure! lab

There is disconnect between what the student does in #1 and #2 and the activity that they are expected to perform. What is to be done if their suggestions are not at all congruent with the apparatus shown?

RESPONSE: The guided discovery in this activity is consistent with the scope of the program. Showing an illustration of the apparatus ensures that the hazards of open-ended experimentation are minimized.

p 401 Answers #9

Let's assume that the air is sealed in the can with no leaks. As the temperature of the can is raised, the pressure of the enclosed gas RISES, NOT DECREASES, and the rubber bulges up with the tip of the straw going down. As the temperature falls, the pressure of the enclosed gas DECREASES, NOT INCREASES, and the rubber bulges inward and the straw points up. So a falling temperature produces the same effect as a rising barometric pressure.

RESPONSE: The reviewer is correct in his concern about this answer. At higher temperatures, air pressure increases, increasing pressure on the balloon and making the straw point downward. As the temperature decreases, the pressure decreases, and the balloon bulges inward and the straw points up. This information will be added to the printing made available for classroom use.

p 477 Figure 6

I have alredy commented that convention uses the LENGTH of the arrow to indicate the magnitude of a vector quantity and not the width. To use a fat arrow of short length is to fly against convention and in any case sends a confusing message.. AT THE LEAST MAKE THE FAT ARROWS LONGER THAN THE THIN ONES.

RESPONSE: The illustration is accurate. The arrows in the illustration are not intended to represent vector quantities and such inferences would not be made by the student. This concept is beyond the scope of most middle school curricula.

p 556 Figure 9

IN SPITE OF THE LAUDABLE GOAL OF INTRODUCING ELECTRON CLOUDS HERE, IN EVERY OTHER ILLUSTRATION I COULD FIND THE AUTHORS HAVE RESORTED TO THE IDEA OF LITTLE ELECTRON BALLS IN NEAT ORBITS

RESPONSE: These models follow a common convention in textbooks up through the college level. The concentric circles are used for clarity to represent orbitals and energy levels not orbits. As models, they are not inaccurate.

p 561 Is That A Fact!

It is NOT A FACT that hydrogen has the fewest isotopes. HELIUM HAS ONLY TWO ISOTOPES, He-3 and He-4, both of which are stable

RESPONSE: The text is not inaccurate. The Berkeley Laboratory Isotope Project lists up to 8 istotopes of helium.

p 589 Figure 13

Check out the color of a helium discharge tube. THE COLOR IS WHITE [or perhaps a slight tinge of pink but yellow - nope!]. And Neon is about the prettiest RED ou are likely to see.

RESPONSE: The color listed for helium is inaccurate. The label for helium will be deleted from the printing made available for classroom use. The reviewer's concern about the neon tube is unclear. Neon gas emits a red color when excited.

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p 223 Combining Atoms 2nd sentence l4
There can not be any doubt that fusion IS the mechanism to produce energy in the Sun [and stars for most of their lives]!

RESPONSE: Perhaps this could have been stated more strongly, however, it is not incorrect as stated.

p 421 Graph showing speed
The RED and BLUE lines cannot represent speed and average speed in a graph of distance vs. time. Speed is the SLOPE in the distance-time graph and for the motion indicated would be a roughly horizontal line [actually a point, depending on the interval over which it is calculated] in a completely separate graph. This would be a fatal error if left unattended.

RESPONSE: The reviewer has identified an error. In the printing made available for classroom use this graph will be clarified by changing the label on the red line to "Distance" and the label for the blue line to "Average distance." The graph will be relabeled "A Graph Showing Distance over Time"

p 424 Calculating Acceleration [near bottom of page]
This formula "works" only if the motion is one-dimensional [confined to the back-and-forth motion along a straight line. There is no way to account for the direction in 2- or 3-dimensional motion in this arithmetical relationship.

RESPONSE: The reviewer has suggested a change that would be appropriate at a much higher level. Students at the middle school level will only calculate acceleration for one-dimensional motion so the equation is not inaccurate.

It is a serious omission that the idea of "instantaneous" and "average" is not developed. An example: a racecar is on a circular track. The average speed may be 200 MPH while the average velocity is zero! The instantaneous acceleration is quite high [and directed toward the center of the circle] while the average acceleration [according to the

relationship] is zero! All this is obvious with the introduction of the proper interpretation of graphs.

RESPONSE: The reviewer has suggested material that would be appropriate at a much higher level. Instantaneous velocity is not part of most middle school curricula.

p 426 A Graph Showing Acceleration

It is misleading to show a curve [non-linear] to illustrate acceleration when a straight line of non-zero slope would show the same. Students may go away thinking that a straight line would not indicate acceleration. In fact, what this graph shows is a non-constant acceleration.

RESPONSE: The graph is accurate in showing the acceleration of the roller coaster as it travels down a curved track (described in the text as a hill). The reviewer is apparently assuming a straight track.

p434 Fig 15

part c) would be correct IF the object is sliding at constant speed. The applied force can be of ANY size if the acceleration is permitted to be greater than zero. Sliding does NOT mean constant speed. And here it looks as though the authors resort to length to show magnitude - at least the force denoted as "sliding friction" is shorter than that for static friction.

RESPONSE: The illustration is accurate. The purpose of the graphic is to show students that the force needed to move the box must be greater than the static friction (described in 15b) and must be greater than the sliding friction represented in 15c.

p 438 Earth's Gravitational Force is l3

The Earth's GRAVITATIONAL FORCE is dependent on both the mass of the earth and the mass of the object, which is attracted toward the earth. The gravitational force on a feather is much smaller than the force on a cannon ball. What IS correct is to say that the GRAVITATIONAL ACCELERATION PRODUCED BY THE EARTH IS LARGE.

RESPONSE: The coverage as shown is accurate. Gravitational acceleration is not part of the curriculum and is not typically covered at this level.

p 439 Astronomy Connection

1 billion solar mass black holes do not form from the collapse of massive stars. Make clear that stellar black holes and those at the centers of active galaxies have very different origins. And the Hawking mechanism DOES allow "stuff" to escape from black holes.

RESPONSE: In the printing made available for classroom use the Astronomy Connection will be edited to avoid the idea that black holes that are a billion times

more massive than the sun were formed by the collapse of massive stars. However, it is not the purpose of this connection to describe the differences between types of black holes.

p 461 Quick Lab1st Law Magic

This IS NOT A DEMONSTRATION OF the 1st law but is instead an application of the second law [as Richard Feynman has pointed out]. There is a frictional force between the napkin and the cup which accelerate the cup in the same direction as which the napkin is pulled. This force is not large and so the acceleration is small. If the napkin is pulled slowly the small acceleration can increase the motion of the cup enough for the cup to follow the napkin. If the napkin is yanked firmly it has a LARGE ACCELERATION and the small friction force on the cup cannot change the velocity of the cup by a large enough amount for the cup to keep up with the napkin. The cup however moves forward a small amount, showing that the 2nd law is still operating. I don't think there are any overwhelming demonstrations of the 1st law.

RESPONSE: We do not disagree that this QuickLab can be described as an application of Newton's 2nd law. However, it also illustrates inertia and the relationship between inertia and mass, and thus can illustrate Newton's 1st law as well.

p 464 Newton's 3rd Law . . .

If 2 vector quantities are to BE EQUAL - and FORCE IS A VECTOR - then the 2 quantities must have both the same magnitude [size] and direction. Therefore, 2 forces cannot be equal [HAVE THE SAME DIRECTION AND MAGNITUDE] if their directions are opposite!! The legitimate statement is:

Whenever 1 object exerts a force on another object, the second exerts a force on the first which is equal in magnitude [size] but opposite in direction.

RESPONSE: The reviewer's comment is a matter of semantics. The text immediately below the item states that the forces are "equal in size [magnitude] and opposite in direction." This statement is identical in meaning to the replacement the reviewer has suggested.

p 467 Bowling is another example . . . [at the top of the page]

Consider the situation in which a cue ball strikes one or more balls and "bounces back.". I know this sort of situation happens in collisions between cars, for example]. The incident car has transferred ALL of its momentum to the struck car and then gained some momentum in the opposite direction? Did the struck car transfer some BACK??

The following paragraph explanation is better and just needs to be repeated for the bowling ball and pins.

RESPONSE: The reviewer's objection is unclear. The motion exhibited in the billiard example differs from the bowling example. We would need more specific information to document an inaccuracy before making a change.

p 468 Station 1 MAGIC EGGS

This is a rotational moment of inertia problem. The two eggs DO NOT HAVE THE SAME MOMENT OF INERTIA.

RESPONSE: Students are merely asked to make observations regarding differences in how the two eggs spin.

Station 2 Coin in a . . . .

This is not a first law problem; it is a 2nd law application

RESPONSE: This station could be explained from the standpoint of Newton's 2nd law. However, significant portions of this station can also be explained using Newton's 1st law. When the card is pulled out quickly, there was not enough friction between the card and the nickel to overcome the inertia of the nickel and thus the nickel did not move laterally. However, once the card was removed, due to Newton's 1st law, the nickel fell downward into the cup. When the card was moved slowly, there was enough friction to create an unbalanced force to move the nickel laterally.

In brief, the key to understanding this demo is that the quickness (time duration) of the pull is important. A string won't break until it has stretched a certain amount, and it takes a bit of time for the upper string to stretch because of the mass of the ball hanging on it. Inertia of that ball (its mass) is important, but the usual "explanations" fail to explain why and under what conditions the upper string will break, or the lower one will. A quick jerk will break the lower string before the upper one has had time to stretch enough. In fact, the demo done twice, once with slow and steady pull, and once with a jerk is demonstrating that the DIFFERENCE in outcome between these two cases isn't MERELY explained by the inertia of the ball. The inertia of the ball is the same in both cases, but the results are different. Therefore, logically, the outcome must also depend on something else.

MANY so-called inertia demos depend on time delay considerations; the duration of the impulse.

RESPONSE: The nature of the inaccuracy is not clear. We would need more specific information to document an inaccuracy before making a change.

p 473 Interpreting Graphics #20

Momentum conservation is only part - not even half - of the story. If momentum conservation alone were the explanation there would be no reason why one should not see TWO balls leave the collection, each with HALF the velocity. But one will NEVER SEE THAT OUTCOME because such a result WOULD NOT CONSERVE ENERGY and the collision of rigid, steel balls is almost completely elastic [the duration of the impulse is exceedingly short]. You just can't have half the momentum "transferred" to

one ball and the remaining half "transferred" to the second ball. Or, for that matter, one-third transferred to each of three ball, etc.

RESPONSE: The question asks the student to relate the situation to conservation of momentum. It does not ask the student to describe the physics of the system. The stated explanation is a reasonable one for a middle school student to make.

p 477 Start Up Activity Question #6

The conclusion that one reaches depends entirely on where, in relation to the load and effort, one places the fulcrum [the eraser]. This is never hinted at. It could be "fixed" by making this an open-ended question with a prompt to explore the effect of position.

RESPONSE: The purpose of a Start-Up activity is for the student to make some concrete observations prior to engaging the content of the chapter. The reviewer's suggestion would be useful if the activity were placed later in the chapter. There is no inaccuracy in the activity as it exists.

p 482 What is a Machine

Proper procedure is the following for changing a tire.

1) Place jack at proper location on frame. Block the free wheels. Extend the jack until the car JUST STARTS TO LIFT
2) Remove hub cap. While the tire STILL FIRMLY touches the ground, loosen the lug-nuts but DO NOT REMOVE. [If the car should now fall off the jack, the still attached wheel will prevent the car from falling onto the ground.]
3) Extend the jack until the wheel is entirely free from the ground
4) Remove lug nuts and carefully lift off wheel

5) Replace with spare tire; screw on the lug-nuts and run them up to a snug fit.
6) Lower jack and then remove
7) Use lug wrench to tighten the lug-nuts to specified torque; replace hubcap and remove wheel blocks.

RESPONSE: This example certainly was not intended to be the actual guidelines on how to change a tire. However, more procedural information will be added to the printing made available for classroom use.

p 489 Examples of a third class lever - Picture and Figure 12

A hammer IS NOT A THIRD CLASS LEVER. To see that this is so, locate the effort and the load force in the illustration. Forces are of only 2 types: contact and non-contact. Students only see gravity, static changes and magnetism as non-contact forces [none of the 3 are present in this example]. To be a contact force there must be an agent and there is NO AGENT for that purple arrow at the top of the picture. The correct interpretation goes something like this:

The heel of the hand is a point of rotation. The thumb [top part of the hand] exerts a force on the hammer handle, resulting IN A TORQUE which produces an ANGULAR ACCELERATION around the axis of rotation [the heel of the hand]. The angular acceleration results in an increase of the kinetic energy of the hammer head. When the hammer head strikes the nail, the nail exerts a force on the hammer head which leads to a torque that decelerates the hammer head and brings the rotation of the hammer to zero. By the 3rd law, the hammer head exerts a force of equal size but opposite direction on the head of the nail. The kinetic energy gained in the collision [a lot is lost] is used to do do work by the nail in splitting the grains of the wood, and prying apart the fibers which one can characterize as the friction between the nail and the wood.

RESPONSE: The explanation offered here is above the level of a typical middle school student. The hammer is a very common example of a third class lever.

p 640 Catapult

Several problems of controlling variables

1) The bottom of the protractor is not the center of the circle on which the degree scale is recorded. So all the angle measurements will be "off."
2) The distance the marshmallow travels depends on the angle of launch as well as the amount by which the spoon is bent. There is careful attention paid to placing the marshmallow at the same spot in the spoon but the amount the spoon is bent before releasing the launch IS MUCH MORE IMPORTANT. Pull back "LIGHTLY" is not nearly quantitative enough.
3) This is a GUESS on the part of students. If they call on their experiences with real balls, the answer will certainly NOT be 45°.

RESPONSE: While the angle measurements will not be exact, they are sufficient for this level of investigation. However, the results will be better if students are told to bend the spoon the same amount for each launch. This change will be made to Step 6 in the printing made available to classrooms. Reviewer comment 3 does not describe a specific inaccuracy.

p 641 Blast Off Answer #9

The "force of the air. . . " ON WHAT? Does the author mean PRESSURE? Is the pressure difference just before release and just after release? I'd suggest that pressure is not a force and is not a good way to analyze a rocket.

RESPONSE: The definition of pressure is force exerted per unit area. The information as stated in the lab is accurate according our resource materials from NASA. In the NASA material titled Rocket Principles, mentioned earlier in this document, it is stated that "A rocket in its simplest form is a chamber enclosing a gas under pressure. A small opening at the end of the chamber allows the gas to escape, and in doing so provides a thrust that propels the rocket in the opposite direction. A good example is a balloon. " This material also describes thrust as force exerted by a fluid.

And this business of ". . the force of the air leaving the balloon is equal and opposite . . ." Can't be equal if it's opposite. See the comment for p 464

RESPONSE: The magnitude of the forces are equal, the directions are opposite. The text states this idea clearly.

p 643 answer #14

Again, " . . . exerted an equal and opposite force . . "

RESPONSE: The magnitude of the forces are equal, the directions are opposite. The text states this idea clearly.

p 644 Inclined . . .

1) As set out, it mixes the effects of friction with the work done to increase the potential energy of the book. Solution => use a wheeled cart [the wheels practically eliminate the friction.

2) What we really wish to show is that although the force may be different for different planes, the work is the same if the height is the same. Solution => Make the height of all the trial planes 50 cm and vary the LENGTH of the plane, either by use of boards of different length or by using one long board and allowing some of the length to extend above the 50 cm of brick. The length of the ramp is always the distance from the floor to the brick support.

The conclusion is that the work done to move the cart up the plane and increase its height above the floor by 50 cm is always the same as is the same as the work done to lift the cart vertically upward 50 cm.

RESPONSE: The lab is accurate as presented and not only helps students see how an inclined plane affects the input force, but allows them to see the effects of friction.

p 729 Concept map for "Motion"

Motion is not DUE TO A FORCE. Newton's 1st law explicitly states that an object in motion continues with constant speed in an unchanging direction. Left unchallenged, most students go away thinking that a force is necessary for motion to persist and, in the absence of a force, motion will diminish and cease.

RESPONSE: Although motion is the result of unbalanced forces, force is not necessary to perpetuate motion. In the printing made available for classroom use the concept map will be changed to avoid the possibility of any misconception.

p 730 Concept map for "Chemical Bonding"

Is a current an example of a metallic bond? Are there moving electrons - an electrical current - in a sheet of aluminum foil??

RESPONSE: The concept map is accurate as presented. The ability to conduct current is a property of metals. However, the concept map does not mention currents. The reviewer comments are based on an inference.

This report was edited to assure focus on the established purpose of identifying errors of fact.