

# Physics Attitudes, Skills, & Knowledge Survey (PASKS) Form 3

Directions to Students:

Do not open this booklet until you are told to do so. Please respond to the following items by marking the best answer on your answer sheet using a #2 pencil. Please do not write on this survey. Scratch paper will be provided on request. If you do not understand what is being asked in an item, please ask the survey administrator for clarification.

Calculators not permitted.



Arizona Collaborative for Excellence in the Preparation of Teachers  
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1. Which best describes your race or ethnic background?
  - A. American Indian
  - B. Asian/Pacific Islander
  - C. Hispanic
  - D. Black
  - E. White
  
2. What is the highest level of education your mother obtained?
  - A. did not finish high school
  - B. high school graduate
  - C. some education after high school
  - D. college graduate
  - E. I don't know
  
3. What is the highest level of education your father obtained?
  - A. did not finish high school
  - B. high school graduate
  - C. some education after high school
  - D. college graduate
  - E. I don't know

Use the following key to indicate to what degree you agree with items 4 – 10.

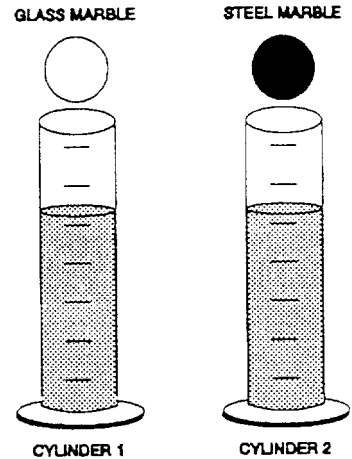
- A. strongly agree   B. agree   C. don't know   D. disagree   E. strongly disagree
4. I am good at physics.
  5. Physics is useful for everyday problems.
  6. Hypotheses/theories can not be proved to be true beyond any doubt.
  7. To test a hypothesis, one needs a prediction.
  8. The primary goal of modern science is to discover facts about nature.
  9. Coming up with hypotheses requires creative thinking.

10. To the right are drawings of two cylinders filled to the same level with water. The cylinders are identical in size and shape.

Also shown at the right are two marbles, one glass and one steel. The marbles are the same size but the steel one is much heavier than the glass one.

When the glass marble is put into Cylinder 1 it sinks to the bottom and the water level rises to the 6th mark. If we put the steel marble into Cylinder 2, the water will rise

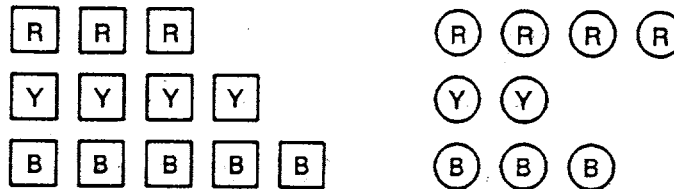
- A. to the same level as it did in Cylinder 1
- B. to a higher level than it did in Cylinder 1
- C. to a lower level than it did in Cylinder 1



11. because

- A. the steel marble will sink faster.
- B. the marbles are made of different materials.
- C. the steel marble is heavier than the glass marble.
- D. the glass marble creates less pressure.
- E. the marbles are the same size.

12. Three red square pieces of wood, four yellow square pieces, and five blue square pieces are put into a cloth bag. Four red round pieces, two yellow round pieces, and three blue round pieces are also put into the bag. All the pieces are then mixed about. Suppose someone reaches into the bag (without looking and without feeling for a particular shape piece) and pulls out one piece.



What are the chances that the piece is a red round or blue round piece?

- A. can not be determined
- B. 1 chance out of 3
- C. 1 chance out of 21
- D. 15 chances out of 21
- E. 1 chance out of 2

13. because
- A. 1 of the 2 shapes is round.
  - B. 15 of the 21 pieces are red or blue.
  - C. there is no way to tell which piece will be picked.
  - D. only 1 of the 21 pieces is picked out of the bag.
  - E. 1 of every 3 pieces is a red or blue round piece.

14. A student put a drop of blood on a microscope slide and then looked at the blood under a microscope. As you can see in the diagram below, the magnified red blood cells look like little round balls. After adding a few drops of salt water to the drop of blood, the student noticed that the cells appeared to become smaller.



Magnified Red Blood Cells

After Adding Salt Water

This observation raises an interesting question: Why do the red blood cells appear smaller?

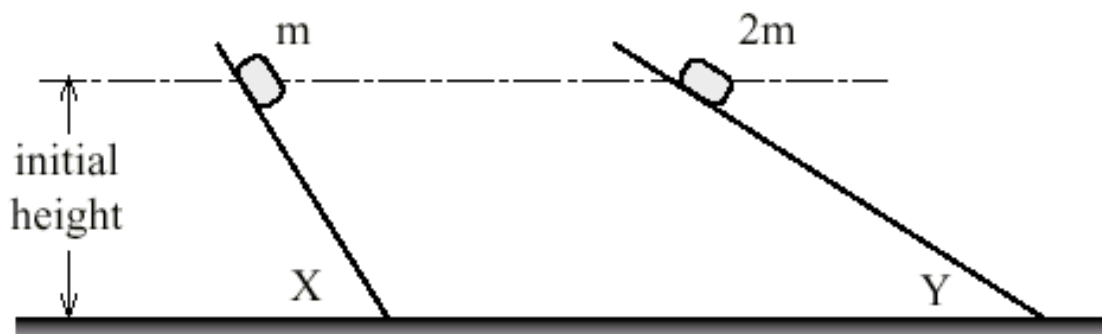
Here are two possible explanations: I. Salt ions ( $\text{Na}^+$  and  $\text{Cl}^-$ ) push on the cell membranes and make the cells appear smaller. II. Water molecules are attracted to the salt ions so the water molecules move out of the cells and leave the cells smaller.

To test these explanations, the student used some salt water, a very accurate weighing device, and some water-filled plastic bags, and assumed the plastic behaves just like red-blood-cell membranes. The experiment involved carefully weighing a water-filled bag in a salt solution for ten minutes and then reweighing the bag.

What result of the experiment would best show that explanation I is probably wrong?

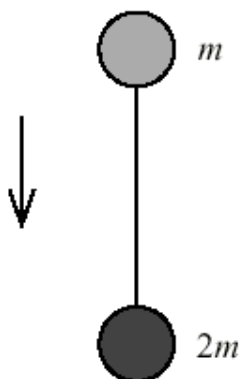
- A. the bag loses weight
  - B. the bag weighs the same
  - C. the bag appears smaller
15. What result of the experiment would best show that explanation II is probably wrong?
- A. the bag loses weight
  - B. the bag weighs the same
  - C. the bag appears smaller

16. Two boxes of mass  $m$  and  $2m$  are allowed to slide down inclined planes X and Y, starting from rest at the same height. The two planes are of different slope and offer negligible friction to the motion of the boxes.



Which one of the following statements is not correct?

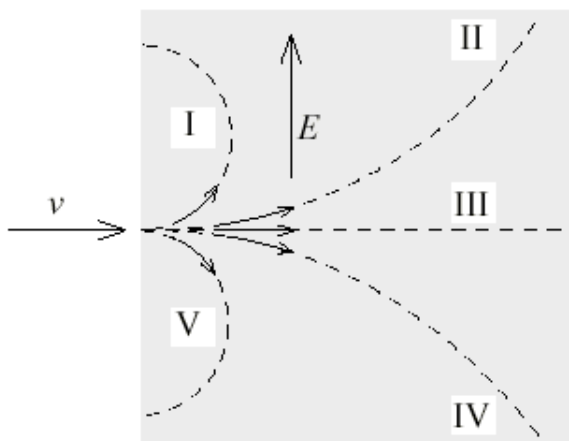
- A. At the top of the planes one of the boxes had half the potential energy of the other box.
  - B. The boxes have the same speed at the bottom of the inclined planes.
  - C. The boxes take the same time to reach the bottom of the inclined planes.
  - D. The box on plane X has greater acceleration than the box on plane Y.
17. Two spheres with masses  $m$  and  $2m$  respectively are connected by a light string and suspended at rest. The system is released by an astronaut standing on the moon. The system falls freely, as shown in the figure.



If  $g$  is the acceleration due to gravity, what is the tension in the string as the system falls?

- A. 0
- B.  $1mg$
- C.  $2mg$
- D.  $3mg$

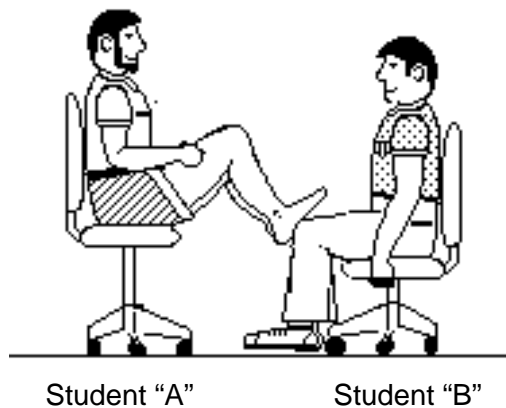
18. Electrons enter a uniform electric field  $E$  with a velocity  $v$  as shown in the figure. The velocity  $v$  is perpendicular to the electric field  $E$ .



Which one of the dashed paths (I, II, III, IV or V) best represents the path of the electrons in the electric field?

- A. I  
 B. II  
 C. III  
 D. IV  
 E. V
19. A woman exerts a constant horizontal force on a large box. As a result, the box moves across a horizontal floor at a constant speed " $v_0$ ".
- The constant horizontal force applied by the woman:
- A. has the same magnitude as the weight of the box.  
 B. is greater than the weight of the box.  
 C. has the same magnitude as the total force which resists the motion of the box.  
 D. is greater than the total force which resists the motion of the box.  
 E. is greater than either the weight of the box or the total force which resists its motion.
20. If the woman in the previous question doubles the constant horizontal force that she exerts on the box to push it on the same horizontal floor, the box then moves:
- A. with a constant speed that is double the speed " $v_0$ " in the previous question.  
 B. with a constant speed that is greater than the speed " $v_0$ " in the previous question, but not necessarily twice as great.  
 C. for a while with a speed that is constant and greater than the speed " $v_0$ " in the previous question, then with a speed that increases thereafter.  
 D. for a while with an increasing speed, then with a constant speed thereafter.  
 E. with a continuously increasing speed.

21. If the woman in question 21 suddenly stops applying a horizontal force to the box, then the box will:
- immediately come to a stop.
  - continue moving at a constant speed for a while and then slow to a stop.
  - immediately start slowing to a stop.
  - continue at a constant speed.
  - increase its speed for a while and then start slowing to a stop.
22. In the figure below, student "a" has a mass of 95 kg and student "b" has a mass of 7 kg. They sit in identical office chairs facing each other. Student "A" places his bare feet on the knees of student "B", as shown. Student "A" then suddenly pushes outward with his feet, causing both chairs to move.



During the push and while the students are still touching one another:

- neither student exerts a force on the other.
  - student "A" exerts a force on student "B", but "B" does not exert any force on "A".
  - each student exerts a force on the other, but "B" exerts the larger force.
  - each student exerts a force on the other, but "A" exerts the larger force.
  - each student exerts the same amount of force on the other.
23. An empty office chair is at rest on a floor. Consider the following forces:
- a downward force of gravity
  - an upward force exerted by the floor
  - a net downward force exerted by the air

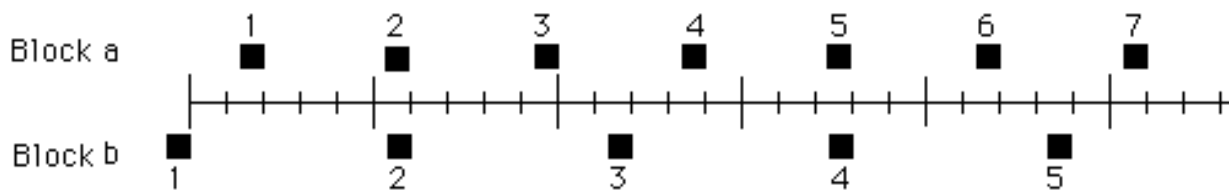
Which of the forces is (are) acting on the office chair?

- i only
- i and ii
- ii and iii
- i, ii, and iii
- none of the forces (since the chair is at rest there are no forces acting upon it.)

24. Despite a very strong wind, a tennis player manages to hit a tennis ball with her racquet so that the ball passes over the net and lands in her opponent's court. Consider the following forces:
- a downward force of gravity
  - a force by the "hit"
  - a force exerted by the air

Which of the above forces is (are) acting on the tennis ball after it has left contact with the racquet and before it touches the ground?

- i only
  - i and ii
  - i and iii
  - ii and iii
  - i, ii, and iii
25. The positions of two blocks at successive 0.20-second time intervals are represented by the numbered squares in the figure below. The blocks are moving toward the right.

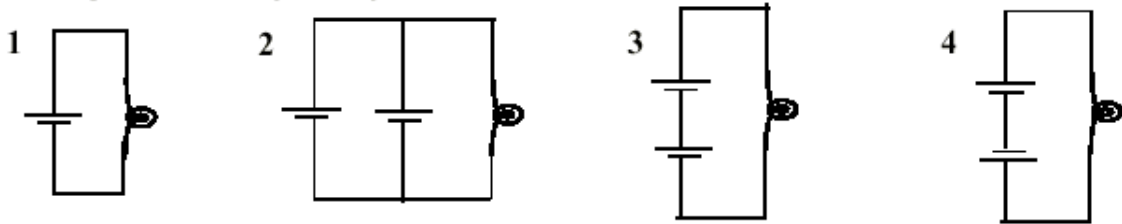


The accelerations of the blocks are related in the following way:

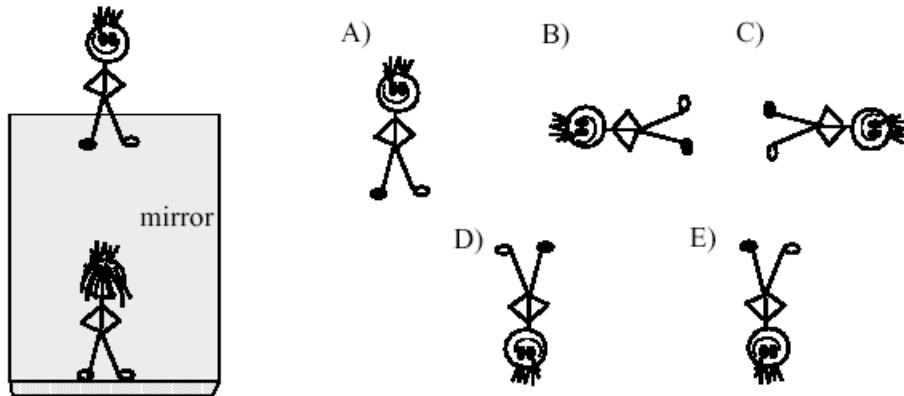
- the acceleration of "a" is greater than the acceleration of "b".
  - the acceleration of "a" equals the acceleration of "b". Both accelerations are greater than zero.
  - the acceleration of "b" is greater than the acceleration of "a".
  - the acceleration of "a" equals the acceleration of "b". Both accelerations are zero.
  - not enough information is given to answer the question.
26. Is electric charge used up in a circuit when a small incandescent light bulb is lit?
- Yes because the charge moving through the bulb filament produces "friction" which heats the filament using up the charge.
  - Yes because charge is absorbed by the bulb filament in order to heat it
  - Yes because charge is transformed into photons when it meets resistance in the filament.
  - No because charge is conserved, but energy is not conserved, because the kinetic energies of the colliding charges are converted directly into light in the filament.
  - No because charge is conserved, and produces heat in the filament by friction, and the heated filament produces the light.



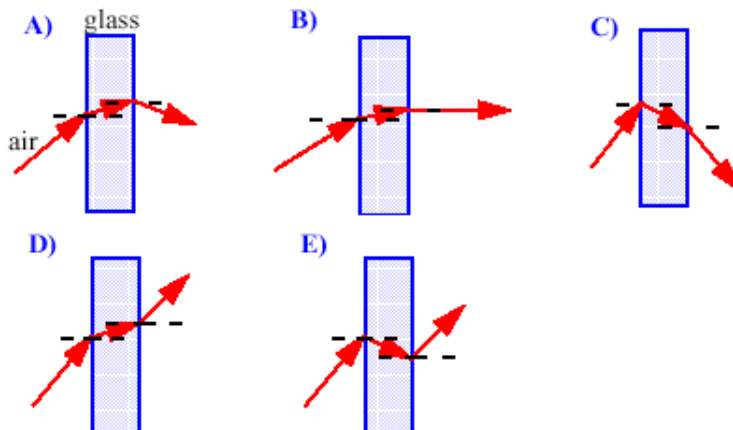
27. The bulbs and batteries illustrated below are identical, and the battery orientations are indicated in the circuit diagrams shown. Which circuit produces the brightest light bulb?



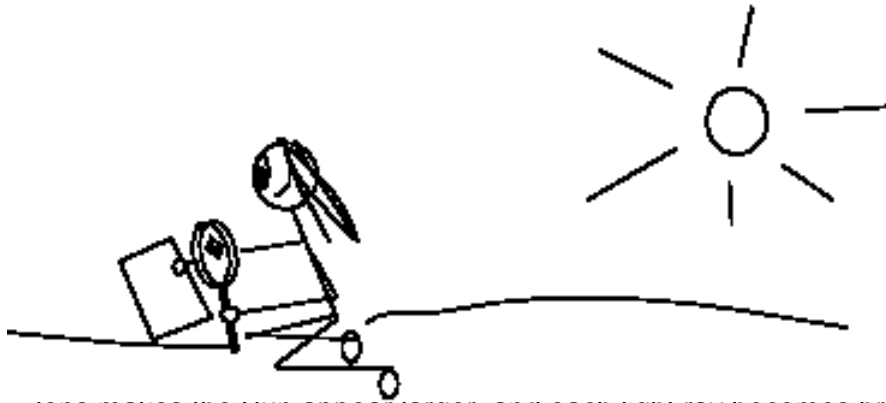
- A. Circuit 1 because one battery does not have to work against another battery  
 B. Circuit 2 because two batteries connected in parallel produce more voltage than either one or two batteries connected in series  
 C. Circuit 3 because two batteries connected in series with the same orientation produce about twice the voltage of a single battery, and more than any other combination shown  
 D. Circuit 4 because two batteries connected in series and oriented in opposite directions produce about twice the voltage of a single battery, and more voltage than any other combination shown.  
 E. Circuits 2 and 3 produce bulbs with the same brightness.
28. Identical twins stand on top of a large plane mirror and look at each other's image as shown. Which is the correct orientation of the reflected image one of the twins sees of the other twin?



29. A light ray is incident on a glass window. Which figure shows the correct path of light?



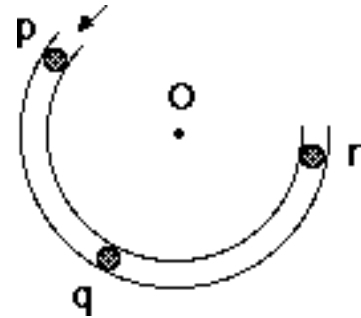
30. A magnifying lens held over a piece of paper with the Sun at your back burns the paper because the:



- A. lens makes the Sun appear larger, and each light ray becomes brighter.
- B. lens makes the Sun appear larger, so each light ray becomes more energetic.
- C. lens makes the Sun appear larger, so more light rays are produced by the lens, making the light brighter.
- D. lens concentrates the light rays into a single small spot, making the light brighter.
- E. lens concentrates the light rays into a single bright light ray.

Questions 31 and 32 refer to the following information:

The figure to the right shows a frictionless channel in the shape of a segment of a circle with center at "O". The channel has been anchored to a frictionless horizontal table top. You are looking down at the table. Forces exerted by the air are negligible. A ball is shot at high speed into the channel at "p" and exits at "r."



31. Consider the following distinct forces:

- i. A downward force of gravity
- ii. A force exerted by the channel pointing from q to O
- iii. A force in the direction of motion
- iv. A force pointing from O to q

Which of the above forces is (are) acting on the ball when it is within the frictionless channel at position "q"?

- A. i only
- B. i and ii
- C. i and iii
- D. i, ii, and iii
- E. i, ii, and iv

32. Which path in the figure to the right would the ball most closely follow after it exits the channel at "r" and moves across the frictionless table top?

- A. A
- B. B
- C. C
- D. D
- E. E

