

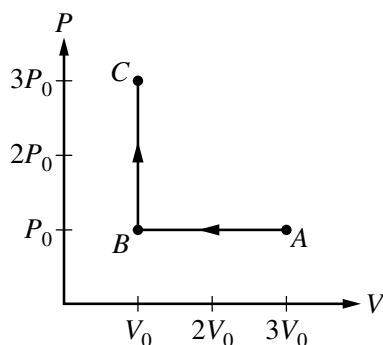
Sample Exam Questions

The sample exam questions that follow illustrate the relationship between the course framework and AP Physics 2 Exam and serve as examples of the types of questions that appear on the exam. After the sample questions, teachers will find a table that shows which science practice(s), learning objective(s), and unit each question relates to. The table also provides the answers to the multiple-choice questions.

Section I: Multiple-Choice Questions

The following are examples of the kinds of multiple-choice questions found on the exam.

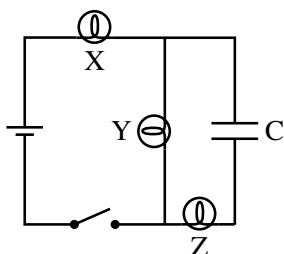
Questions 1 and 2 refer to the following material.



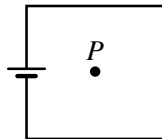
A sealed cylinder with a moveable piston contains N molecules of an ideal gas. The gas is initially in state A shown on the above PV diagram, where P is pressure and V is volume. The gas is then taken through the two processes shown.

- Which of the following correctly ranks the average speed v of the molecules in states A , B , and C ?
 - $(v_B = v_C) > v_A$
 - $v_C > v_B > v_A$
 - $(v_A = v_C) > v_B$
 - $v_B > (v_A = v_C)$
- Which of the following correctly ranks the magnitude of the force F the gas exerts on the piston in states A , B , and C ?
 - $F_A > F_C > F_B$
 - $F_C > F_B > F_A$
 - $(F_A = F_C) > F_B$
 - $F_C > (F_A = F_B)$

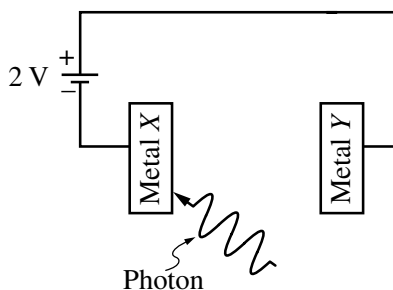
3. A cylindrical resistor is connected to a battery with an emf of 15.0 V, resulting in a current of 3.0 A in the circuit. The resistor is removed, and a new resistor of the same material with twice the radius and twice the length of the original resistor is connected to the battery. What is the new current in the circuit?
- (A) 1.5 A
 (B) 3.0 A
 (C) 6.0 A
 (D) 12.0 A
4. Water of density 1000 kg/m^3 is pumped through a straight, horizontal hose and out a nozzle that has an opening with a cross-sectional area 10 times smaller than that of the hose. The water exits the nozzle at a speed of 10.0 m/s. The difference between the pressure of the fluid when it is in the hose near the pump and as it exits the nozzle is
- (A) $4.5 \times 10^3 \text{ Pa}$
 (B) $4.95 \times 10^4 \text{ Pa}$
 (C) $9.9 \times 10^4 \text{ Pa}$
 (D) $4.95 \times 10^6 \text{ Pa}$



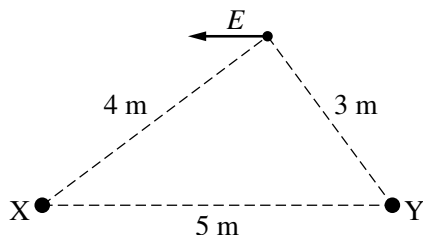
5. In the circuit shown above, bulbs X, Y, and Z are identical and capacitor C is initially uncharged. The switch is closed at time $t = 0$. Which of the following describes the brightness of bulbs Y and Z after the switch is closed?
- (A) Both bulbs light and remain lit.
 (B) Bulbs Y and Z are both initially lit, and bulb Y eventually goes out.
 (C) Bulbs Y and Z are both initially lit, and bulb Z eventually goes out.
 (D) Bulb Y is always lit and bulb Z is always out.
6. A student in a classroom sees a tree outside that is far from the classroom window and uses a concave mirror to form an image of the tree on a screen. Which of the following best describes the image?
- (A) Real and near the center of curvature of the mirror
 (B) Real and near the focal point of the mirror
 (C) Virtual and near the center of curvature of the mirror
 (D) Virtual and near the focal point of the mirror



7. A circuit consists of a battery and some wire with significant resistance. The wire is bent so that the circuit is in the shape of a square, and the circuit is aligned in the plane of the page, as shown above. Which of the following best describes the direction of the magnetic field near point P ?
- (A) Clockwise around point P
 (B) Out of the page
 (C) Into the page
 (D) The field has no direction because the magnitude of the field is zero.

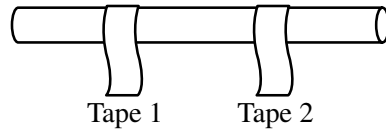


8. A photon with energy 4 eV is incident on metal X, which has a work function of 3 eV. Metal X is electrically connected to metal Y through a 2V voltage supply with the polarity shown in the figure above. What is the maximum kinetic energy an emitted electron could have when it reaches metal Y?
- (A) 1 eV
 (B) 2 eV
 (C) 3 eV
 (D) 5 eV



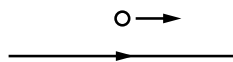
9. Two charged spheres, X and Y, are held fixed at two vertices of a triangle, as shown above. The direction of the electric field E at the third vertex due to the two spheres is also shown. Which of the following correctly indicates the sign of the charges on the spheres?

- | | | | | | | | | | | | |
|-----------------|---|-----------------|-----------------|----------|----------|-----|---|-----------------|-----------------|----------|----------|
| (A) | <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><i>Sphere X</i></td><td><i>Sphere Y</i></td></tr><tr><td>Positive</td><td>Positive</td></tr></table> | <i>Sphere X</i> | <i>Sphere Y</i> | Positive | Positive | (C) | <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><i>Sphere X</i></td><td><i>Sphere Y</i></td></tr><tr><td>Negative</td><td>Positive</td></tr></table> | <i>Sphere X</i> | <i>Sphere Y</i> | Negative | Positive |
| <i>Sphere X</i> | <i>Sphere Y</i> | | | | | | | | | | |
| Positive | Positive | | | | | | | | | | |
| <i>Sphere X</i> | <i>Sphere Y</i> | | | | | | | | | | |
| Negative | Positive | | | | | | | | | | |
| (B) | <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><i>Sphere X</i></td><td><i>Sphere Y</i></td></tr><tr><td>Positive</td><td>Negative</td></tr></table> | <i>Sphere X</i> | <i>Sphere Y</i> | Positive | Negative | (D) | <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><i>Sphere X</i></td><td><i>Sphere Y</i></td></tr><tr><td>Negative</td><td>Negative</td></tr></table> | <i>Sphere X</i> | <i>Sphere Y</i> | Negative | Negative |
| <i>Sphere X</i> | <i>Sphere Y</i> | | | | | | | | | | |
| Positive | Negative | | | | | | | | | | |
| <i>Sphere X</i> | <i>Sphere Y</i> | | | | | | | | | | |
| Negative | Negative | | | | | | | | | | |



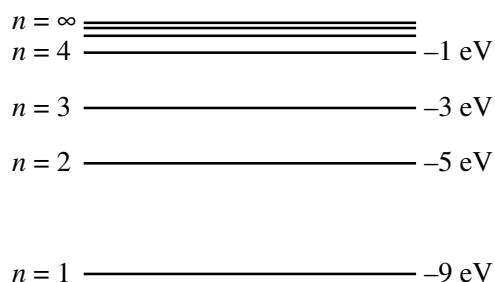
	Tape 1	Tape 2
Positively charged object	Attracted	Repelled
Negatively charged object	Repelled	Attracted
Uncharged object	Attracted	Attracted

10. Two pieces of transparent adhesive tape, labeled 1 and 2, are stuck together. The pieces of tape are then quickly pulled apart and stuck to an insulating rod, as shown above. Three objects are brought near each piece of tape, one at a time. One of the objects is positively charged, one is negatively charged, and one is uncharged. The reaction of each piece of tape is recorded in the table above. Based on the results, what can be concluded about the signs of the charges on the tapes, and why?
- (A) Tape 1 is positively charged, because it is attracted to the positively charged object. Tape 2 is negatively charged because it is repelled by the positively charged object.
- (B) Tape 1 is negatively charged, because it is repelled by the negatively charged object. Tape 2 is positively charged, because it is repelled by the positively charged object.
- (C) Tape 1 and tape 2 are both positively charged because they are both attracted to the uncharged object.
- (D) Tape 1 and tape 2 are both negatively charged because they are both attracted to the uncharged object.



11. At the instant shown above, a particle with a positive charge travels to the right near a wire carrying a current to the right. What is the direction of the force exerted by the charge on the wire?
- (A) Toward the bottom of the page
- (B) Toward the top of the page
- (C) Out of the page
- (D) Into the page

12. A beam of electrons is incident on a crystal, creating a diffraction pattern. How should the speed of the electrons be changed to increase the separation of the spacing of the maxima in the pattern, and why would the pattern change?
- (A) The speed should be increased, because that would increase the de Broglie wavelength of the electrons.
- (B) The speed should be increased, because that would decrease the de Broglie wavelength of the electrons.
- (C) The speed should be decreased, because that would increase the de Broglie wavelength of the electrons.
- (D) The speed should be decreased, because that would decrease the de Broglie wavelength of the electrons.
13. A canister and the hydrogen gas it contains are at 100°C . The canister is placed in a vacuum, and the temperature of the canister and gas begins to decrease. Which of the following statements of reasoning best explains how the canister-gas system loses energy?
- (A) High-energy hydrogen molecules collide with lower-energy molecules and the walls inside the canister, losing energy during the collisions.
- (B) The molecules collide with the walls of the canister, causing the canister molecules to vibrate and carry energy from the canister to the canister's surroundings.
- (C) Energy is released from the canister as infrared radiation that can travel through the vacuum, causing a decrease in the average energy of the canister and the molecules.
- (D) Energy is released from the canister and travels through the vacuum by convection, causing a decrease in the average energy of the canister and the molecules.



14. The figure above shows the energy levels for a hypothetical atom. For which transitions will the emitted photon have an energy of 4 eV? Select two answers.
- (A) $n=4$ to $n=3$
 - (B) $n=4$ to $n=2$
 - (C) $n=3$ to $n=1$
 - (D) $n=2$ to $n=1$
15. A student is asked to use the steps listed below to induce a positive charge on an aluminum soda can. In what order could the steps be done to accomplish the task? Select two answers.
- Step W: Bring a negatively charged rod near, but not touching, the can.
- Step X: Ground the can.
- Step Y: Remove the ground from the can.
- Step Z: Move the charged rod away from the can.
- (A) W, X, Y, Z
 - (B) W, X, Z, Y
 - (C) X, W, Y, Z
 - (D) X, W, Z, Y