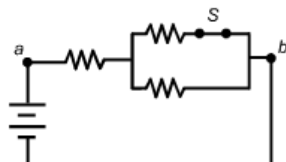


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Physics (Grades 9–12)

Subtest 2 Sample Items

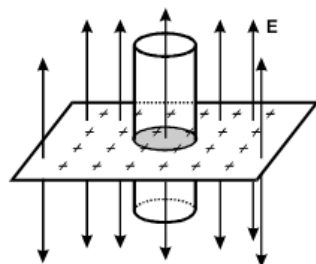
1. The diagram below shows a circuit consisting of a switch S and several resistors of resistance R .



Which of the following statements best describes what will happen if switch S is opened?

- A. The equivalent resistance of the circuit will decrease.
- B. The power supplied to the circuit will decrease.
- C. The current through the circuit will increase.
- D. The voltage across a and b will increase.

2. A very large plane surface carries a uniform surface charge density of σ . A cylinder of height h and radius r is placed on the plane such that the sides of the cylinder are perpendicular to the plane and the top and bottom of the cylinder are parallel to the plane, as shown in the diagram below.



What is the magnitude of the electric field, E , through the cylinder above the plane?

- A. $E = 2\sigma/\epsilon_0$
- B. $E = \sigma/\epsilon_0$
- C. $E = 2\sigma\pi r/\epsilon_0$
- D. $E = \sigma\pi h/\epsilon_0$

3. A person would like to use a thin converging lens to generate a real image of an object placed 20 cm in front of the lens. The height of the object is 3.0 cm, and desired height of the image is 6.0 cm. What focal length should the lens have?

- A. 6.7 cm
- B. 9.0 cm
- C. 13.3 cm
- D. 40 cm

4. An ideal gas has a heat capacity of 20 J/(mol·K). One mole of the gas is in a cylinder and absorbs 1000 J of heat and lifts a 10 kg mass a vertical distance of 2 m while expanding. If

the initial temperature of the gas is 300 K, what is the approximate final temperature of the gas?

- A. 251 K
- B. 260 K
- C. 340 K
- D. 349 K

5. Which of the following best characterizes a basic property of semiconductors?

- A. Electrons in a semiconductor are free to scatter from atom to atom, resulting in a low value of conductivity.
- B. Semiconductors contain a region where the valence band energies overlap with the conduction band.
- C. Electrons in the atoms are paired with electron holes that pass through the material with almost zero resistance.
- D. Electrons with sufficient energy can transition a narrow energy gap between the valence band and the conduction band.

Answer Key

Item Number	Correct Response	Subarea	Objective
1	B	I. Electricity and Magnetism	0010
2	A	I. Electricity and Magnetism	0011
3	C	II. Geometrical and Physical Optics	0013
4	C	III. Kinetic Theory and Contemporary Physics	0015
5	D	III. Kinetic Theory and Contemporary Physics	0017

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