SAT Physics Practice Papers 11

SET 1

1. What is the wavelength of an X-ray whose frequency is 1.0×10^{18} Hz?

A. 3.3×10^{-11} m

B. 3.0×10^{-10} m

C. 3.3×10^{-9} m

D. 3.0×10^{-8} m

E. 3.0×10^{26} m

2. In Young's double-slit interference experiment, what is the difference in path length of the light waves from the two slits at the center of the first bright fringe above the central maximum?
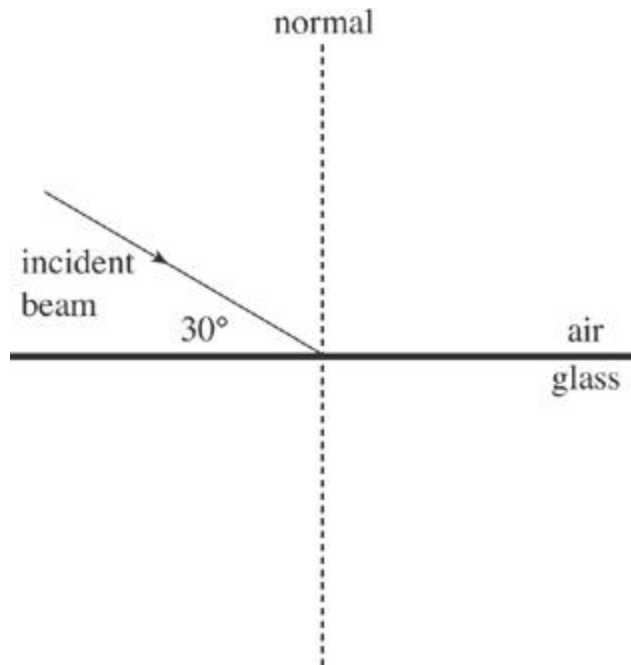
A. 0

B. $\dfrac{1}{4}\lambda$

C. $\dfrac{1}{2}\lambda$

D. λ

E. $\dfrac{3}{2}\lambda$

3. A beam of light in air is incident upon the smooth surface of a piece of flint glass, as shown

normal

incident
beam
30°

air

glass

If the reflected beam and refracted beam are perpendicular to each other, what is the index of refraction of the glass?

A. $\dfrac{1}{2}$

B. $\dfrac{1}{2}\sqrt{3}$

C. $\sqrt{3}$

D. 2

E. $2\sqrt{3}$

4. When green light (wavelength = 500 nm in air) travels through diamond (refractive index = 2.4), what is its wavelength?

A. 208 nm

B. 357 nm

C. 500 nm

D. 700 nm

E. 1,200 nm

5. A beam of light traveling in medium 1 strikes the interface to another transparent medium, medium 2. If the speed of light is less in medium 2 than in medium 1, the beam will

A. refract toward the normal

B. refract away from the normal

C. undergo total internal reflection

D. have an angle of reflection smaller than the angle of incidence

E. have an angle of reflection greater than the angle of incidence

6. If a clear liquid has a refractive index of 1.45 and a transparent solid has an index of 2.90 then, for total internal reflection to occur at the interface between these two media, which of the following must be true?

incident beam originates in   at an angle of incidence greater than

A. (A) the solid   30°

B. (B) the liquid   30°

C. (C) the solid   60°

D. (D) the liquid   60°

E. (E) Total internal reflection cannot occur.

7. An object is placed 60 cm in front of a concave spherical mirror whose focal length is 40 cm. Which of the following best describes the image?

Nature of image   Distance from mirror

A. (A) Virtual   24 cm

B. (B) Real   24 cm

C. (C) Virtual   120 cm

D. (D) Real   120 cm

E. (E) Real   240 cm

8. An object is placed 60 cm from a spherical convex mirror. If the mirror forms a virtual image 20 cm from the mirror, what's the magnitude of the mirror's radius of curvature?

A. 7.5 cm

B. 15 cm

C. 30 cm

D. 60 cm

E. 120 cm

9. The image created by a converging lens is projected onto a screen that's 60 cm from the lens. If the height of the image is $\dfrac{1}{4}$ the height of the object, what's the focal length of the lens?

A. 36 cm

B. 45 cm

C. 48 cm

D. 72 cm

E. 80 cm

10. Which of the following is true concerning a bi-concave lens?

A. Its focal length is positive.

B. It cannot form real images.

C. It cannot form virtual images.

D. It can magnify objects.

E. None of the above

SET 2

1. How much heat is required to raise the temperature of a 0.04 kg stainless steel spoon from 20°C to 50°C if the specific heat of stainless steel is 0.50 kJ/kg × °C ?

A. 200 J

B. 400 J

C. 600 J

D. 800 J

E. 1,000 J

2. The melting point of copper is 1,080°C and its heat of fusion is 200 kJ/kg. If a copper coin at this temperature is completely melted by the absorption of 2,000 J of heat, what is the mass of the coin?

A. $\dfrac{1}{1,080 \text{ kg}}$

B. $\dfrac{1}{540 \text{ kg}}$

C. $\dfrac{1}{108 \text{ kg}}$

D. $\dfrac{1}{100 \text{ kg}}$

E. $\dfrac{1}{50 \text{ kg}}$

3. Water has the specific heat 4.186 kJ/kg•°C, a boiling point of 100°C, and a heat of vaporization of 2,260 kJ/kg. A sealed beaker contains 100 g of water that's initially at 20°C. If the water absorbs 100 kJ of heat, what will its final temperature be?

A. 100°C

B. 119°C

C. 143°C

D. 183°C

E. 239°C

4. On a cold winter day (5°C), the foundation block for a statue is filled with 2.0 m^3 of concrete. By how much will the concrete's volume increase on a very warm summer day (35°C) if its coefficient of volume expansion is 4.0 × 10$^{-5/°}$C ?

A. 160 cm^3

B. 1,200 cm^3

C. 1,600 cm^3

D. 2,400 cm^3

E. 3,200 cm^3

5. An ideal gas is confined to a container whose volume is fixed. If the container holds n moles of gas, by what factor will the pressure increase if the absolute temperature is increased by a factor of 2 ?

A. $\dfrac{2}{(nR)}$

B. 2

C. 2nR

D. $\dfrac{2}{n}$

E. $\dfrac{2}{R}$

6. Two large glass containers of equal volume each hold 1 mole of gas. Container 1 is filled with hydrogen gas (2 g/mol), and Container 2 holds helium (4 g/mol). If the pressure of the gas in Container 1 equals the pressure of the gas in Container 2, which of the following is true?

A. The temperature of the gas in Container 1 is lower than the temperature of the gas in Container 2.

B. The temperature of the gas in Container 1 is greater than the temperature of the gas in Container 2.

C. The value of R for the gas in Container 1 is $\dfrac{1}{2}$ the value of R for the gas in Container 2.
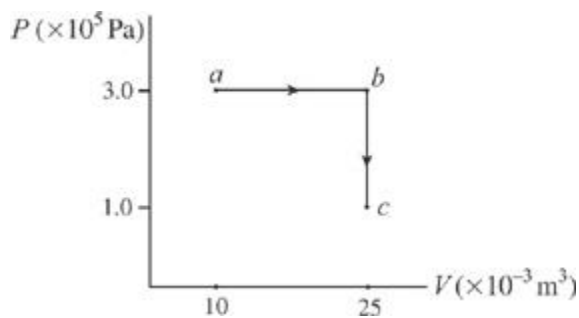
D. The rms speed of the gas molecules in Container 1 is lower than the rms speed of the gas molecules in Container 2.

E. The rms speed of the gas molecules in Container 1 is greater than the rms speed of the gas molecules in Container 2.

7. Through a series of thermodynamic processes, the internal energy of a sample of confined gas is increased by 560 J. If the net amount of work done on the sample by its surroundings is 320 J, how much heat was transferred between the gas and its environment?

A. 240 J absorbed

B. 240 J dissipated

C. 880 J absorbed

D. 880 J dissipated

E. None of the above

8. What's the total work performed on the gas as it's transformed from state *a* to state *c*, along the path indicated?

A. 1,500 J

B. 3,000 J

C. 4,500 J

D. 5,000 J

E. 9,500 J

9. During each cycle, a heat engine absorbs 400 J of heat from its high-temperature source and discards 300 J of heat into its low-temperature sink. What is the efficiency of this engine?

A. $\dfrac{1}{7}$

B. $\dfrac{1}{4}$

C. $\dfrac{3}{7}$

D. $\dfrac{4}{7}$

E. $\dfrac{3}{4}$

10. Of the following, which is the best description of the second law of thermodynamics?

A. The total energy of the universe is a constant.

B. The efficiency of a heat engine can never be greater than 50 percent.

C. The amount of heat required to vaporize a liquid is greater than the amount of heat required to melt a solid of the same substance.

D. The entropy of the universe is always increasing.

E. As the altitude increases, the boiling point of water decreases.

SET 3

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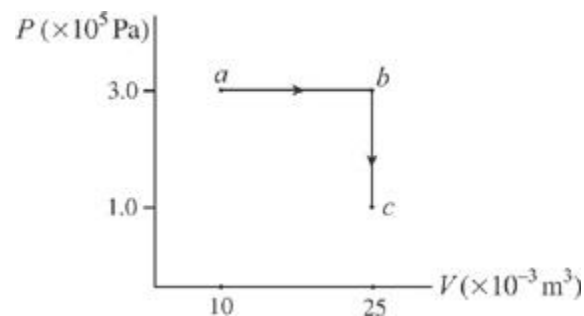
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