

Closed book. Clearly circle your choice. No work needs to be shown for multiple-choice questions. No partial credit is given for multiple-choice questions.

This quiz continues from questions (1)-(5) on the other side of this page.

For questions (6)-(7), a Harvey Building Products¹ vinyl casement window has a thermal resistance of 0.33 K/watt. The temperature difference between inside and outside is 30° C.

6. [3.0 points.] If the temperature difference between inside and outside increases to 40° C, the rate of heat conduction through this window would:
- (A) decrease.
 - (B) remain the same.
 - (C) increase.
 - (D) (Not enough information is given.)
7. [3.0 points.] The SymphonyShades™ Virtuoso® window shade² is also claimed to have a thermal resistance of approximately 0.33 K/watt. If this window shade completely covers the window, the rate of heat conduction will be _____ of the original (uncovered) value.
- (A) one-third.
 - (B) one-half.
 - (C) two-thirds.
 - (D) twice.
 - (E) (No change in rate of heat conduction.)

8. [3.0 points.] Wax droplets in a lava lamp will rise after being heated in the base because their _____ increases, making their _____ decrease.
- (A) density; mass.
 - (B) density; volume.
 - (C) mass; volume.
 - (D) mass; density.
 - (E) volume; mass.
 - (F) volume; density.

For questions (9)-(10), a black wood stove has a surface area of 1.6 m² and a surface temperature of 180° C. The room temperature is 15° C.

9. [3.0 points.] What is the net rate at which heat is radiated into the room?
- (A) 67 watts.
 - (B) 95 watts.
 - (C) 3.2×10³ watts.
 - (D) 3.8×10³ watts.
10. [3.0 points.] To increase the net rate of heat radiated by the stove, one should:
- (A) increase the temperature of the stove.
 - (B) decrease the temperature of the room.
 - (C) (Both of the above choices.)
 - (D) (None of the above choices.)

Equations and constants:

$$T_c = T - 273.15; \frac{\text{heat flow}}{\text{time}} = \frac{\Delta T}{R}; R = \frac{d}{\kappa A}$$

$$\frac{\text{heat flow}}{\text{time}} = e\sigma A(T_{obj}^4 - T_{env}^4); \sigma = 5.670 \times 10^{-8} \frac{\text{watts}}{\text{m}^2 \cdot \text{K}^4}$$

¹ R-factor = 0.33, ENERGY STAR rated, 19 square feet.
http://www.harveybp.com/upload/products/literature/Harvey_AccessoryWindows_Brochure.pdf

² R-factor = 0.34, single-cellular light-filtering fabric, 19 square feet.
http://symphonyshades.com/single_cell_shades.html
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