

24. A glass rod that is 1.0 m long at 0 °C increases its length by 0.68 mm when heated to 80 °C. The coefficient of linear expansion of this glass is approximately

- A) $8.5 \times 10^{-6} \text{ (C}^\circ\text{)}^{-1}$.
- B) $6.8 \times 10^{-4} \text{ (C}^\circ\text{)}^{-1}$.
- C) $0.013 \text{ (C}^\circ\text{)}^{-1}$.
- D) $1.0 \text{ (C}^\circ\text{)}^{-1}$.
- E) $80 \text{ (C}^\circ\text{)}^{-1}$.

$$\Delta L = \alpha L_0 \Delta T$$

$$\alpha = \frac{\Delta L}{L_0 \Delta T}$$

$$= \frac{0.68 \times 10^{-3}}{1 \cdot 80^\circ\text{C}} = 0.0000085 \text{ C}^\circ$$

25. Two moles of a gas at $T = 350 \text{ K}$ expand quasi-statically and isothermally from an initial volume of 20 L to a final volume of 60 L. The change in entropy of the gas during this expansion is

- A) -17.4 J/K .
- B) 18.3 J/K .
- C) 20.4 J/K .
- D) -24.6 J/K .
- E) 27.8 J/K .

$$Q = nRT \ln \frac{V_b}{V_a}$$

$$= 2 \cdot 8.314 \cdot 350 \cdot \ln \frac{60}{20}$$

$$= 6393$$

$$\Delta S = \frac{Q}{T} \text{ for isothermal process}$$

$$\Delta S = \frac{6393}{350}$$

$$= 18.3 \text{ J/K}$$

26. The change in the entropy of the universe due to an operating Carnot engine

- A) is zero.
- B) must be positive.
- C) must be negative.
- D) could be positive or negative.
- E) is meaningless to consider because a Carnot engine has no connection to entropy.

27. A refrigerator has a coefficient of performance 5.0. How much heat is exhausted to the hot reservoir when 200 kJ of heat are removed from the cold reservoir?

- A) 50 kJ
- B) 150 kJ
- C) 200 kJ
- D) 240 kJ
- E) Not enough information is given to answer this question.

$$K = 5 \quad Q_c = 200 \text{ kJ} \quad Q_H = ?$$

$$K = \frac{Q_c}{Q_H - Q_c}$$

$$5 = \frac{200}{(Q_H - 200)}$$

$$5Q_H - 1000 = 200$$

$$Q_H = \frac{200 + 1000}{5}$$

$$= 240 \text{ kJ}$$