

Mathematical Physiology

Algebra · Practice Test · 8 Questions

1. If the body mass index (BMI) is represented by the equation $BMI = w/h^2$, where w is weight in kg and h is height in meters, what is the weight of a person with a BMI of 25 and a height of 1.8 meters?

- A) 72.0 kg
- B) 81.0 kg
- C) 67.5 kg
- D) 45.0 kg

2. The volume of blood pumped by the heart per minute, known as Cardiac Output (CO), is calculated as $CO = SV \times HR$, where SV is stroke volume and HR is heart rate. If CO is 5.0 L/min and HR is 75 beats/min, what is the approximate stroke volume per beat?

- A) 66.7 mL
- B) 75.0 mL
- C) 50.0 mL
- D) 15.0 mL

3. The concentration of a substance in the blood can be expressed by the formula $C = A/V$, where A is the total amount of substance and V is the plasma volume. If a patient has 150 mg of a medication in a plasma volume of 3 liters, what is the concentration in mg/L?

- A) 45 mg/L
- B) 50 mg/L
- C) 30 mg/L
- D) 40 mg/L

4. According to the Henderson-Hasselbalch equation $pH = pKa + \log([HCO_3^-]/[H_2CO_3])$, what is the ratio of bicarbonate to carbonic acid if the blood pH is 7.4 and the pKa of the buffer system is 6.1?

- A) 10:1
- B) 15:1
- C) 20:1
- D) 25:1

5. Using the formula for vital capacity $VC = IRV + TV + ERV$, where IRV is inspiratory reserve volume (3000 mL), TV is tidal volume (500 mL), and ERV is expiratory reserve volume (1100 mL), what is the total vital capacity?

- A) 4500 mL
- B) 4600 mL
- C) 4800 mL
- D) 5000 mL

6. The clearance rate (CI) of a substance by the kidneys is calculated as $CI = (U \times V) / P$, where U is urine concentration, V is urine flow rate, and P is plasma concentration. If $U=100$, $V=1$, and $P=2$, what is the clearance rate?

- A) 25
- B) 50
- C) 100
- D) 200

7. In the context of pharmacokinetics, the half-life ($t_{1/2}$) is calculated using the formula $t_{1/2} = 0.693/k$, where k is the elimination rate constant. If k is 0.1386 hr⁻¹, what is the half-life of the drug?

- A) 2 hours
- B) 5 hours
- C) 8 hours
- D) 10 hours

8. Mean Arterial Pressure (MAP) is approximated by the equation $MAP = DBP + 1/3(SBP - DBP)$, where SBP is systolic and DBP is diastolic pressure. If SBP is 120 and DBP is 80, what is the MAP?

- A) 93.3 mmHg
- B) 96.7 mmHg
- C) 100.0 mmHg
- D) 86.7 mmHg