Mathematical Physiology

Algebra · Answer Key · 8 Questions

1. If the body mass index (BMI) is represented by the equation BMI = w/h², 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 × 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([HCO3-]/[H2CO3]), 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 (Cl) of a substance by the kidneys is calculated as Cl = (U × 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 (t1/2) is calculated using the formula t1/2 = 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