OJEE 2026 BSc Nursing 4 May Shift 2

Question Paper (Memory-Based) with Solutions PDF

Conducted by Odisha Joint Entrance Examination Committee (OJEEC)

General Instructions

(i) The examination will be conducted in Computer-Based Test (CBT) mode.

(ii) Each question carries +4 marks for correct answer and 1 mark for wrong answer.

(iii) The total number of questions and duration will vary depending on the course.

(iv) Duration of the exam is 2 hours (120 minutes).

1. The volume of air remaining in lungs after a forceful expiration is called:

(A) Tidal volume

(B) Residual volume

(C) Inspiratory reserve volume

(D) Vital capacity

Correct Answer: (B) Residual volume

Solution:

Step 1: Understanding the Concept:

Respiratory volumes represent different quantities of air inhaled, exhaled, or remaining in the lungs during various phases of the breathing cycle.

Even after a person performs the most forceful expiration possible, the lungs are never completely empty of air.

Step 2: Detailed Explanation:

1. **Tidal Volume (TV):** This is the volume of air inspired or expired during a normal, relaxed breath, which is approximately 500 mL in a healthy adult.

2. **Residual Volume (RV):** This is the specific volume of air that remains trapped in the lungs even after a maximum forced expiration. This volume ensures that the lungs do not collapse

and that gas exchange continues even between breaths. Its typical value ranges from 1100 mL to 1200 mL.

3. **Inspiratory Reserve Volume (IRV):** The additional volume of air that can be inhaled forcibly after a normal inspiration.

4. **Vital Capacity (VC):** The maximum volume of air a person can breathe out after a maximum inhalation, encompassing TV, IRV, and ERV.

Step 3: Final Answer:

The volume of air that remains in the lungs after forceful expiration is the Residual Volume.

Quick Tip: The Residual Volume (RV) cannot be measured using a simple spirometer because the air never leaves the respiratory system. It must be calculated using gas dilution methods.

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2. Oxygen is transported in blood mainly as:

(A) Oxyhaemoglobin

(B) Dissolved oxygen

(C) Carbaminohaemoglobin

(D) Bicarbonate ions

Correct Answer: (A) Oxyhaemoglobin

Solution:

Step 1: Understanding the Concept:

Oxygen transport in humans involves two primary methods: binding to specialized respiratory pigments in red blood cells or dissolving directly into the blood plasma.

Step 2: Detailed Explanation:

Oxygen transport occurs in the following proportions:

1. **As Oxyhaemoglobin:** Approximately 97% of the oxygen is transported by Red Blood Cells (RBCs). Haemoglobin (Hb), the red-colored iron-containing pigment, binds with oxygen in a reversible manner to form oxyhaemoglobin (HbO_2).

2. **In Dissolved State:** The remaining 3% of oxygen is carried in a dissolved state through the

blood plasma.

Note that options (C) and (D) are modes of transport for Carbon Dioxide (CO_2), where 70% is carried as bicarbonate and $20-25\%$ as carbaminohaemoglobin.

Step 3: Final Answer:

The primary mode of oxygen transport is through the formation of oxyhaemoglobin.

Quick Tip: Each molecule of haemoglobin can bind to a maximum of four oxygen molecules. This binding is influenced by factors like pO_2, pCO_2, H^+ concentration, and temperature.

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3. In emphysema, there is:

(A) Fluid in alveoli

(B) Infection of lungs

(C) Destruction of alveolar walls

(D) Narrowing of bronchi

Correct Answer: (C) Destruction of alveolar walls

Solution:

Step 1: Understanding the Concept:

Emphysema is a chronic, long-term respiratory disorder that affects the structures responsible for gas exchange. It is classified under Chronic Obstructive Pulmonary Disease (COPD).

Step 2: Detailed Explanation:

In the condition known as emphysema:

1. The alveolar walls (the delicate walls of the air sacs) are damaged or destroyed over time.
2. This destruction results in larger, fewer air sacs instead of many tiny ones, which drastically reduces the total surface area available for the exchange of oxygen and carbon dioxide.
3. Furthermore, the elastic fibers of the lungs are damaged, leading to air trapping and difficulty in exhaling.

A major known cause of this condition is chronic cigarette smoking.

Step 3: Final Answer:

Emphysema is characterized by the structural destruction of alveolar walls.

Quick Tip: Emphysema is considered an irreversible condition. While treatments can manage symptoms, the destroyed alveolar walls do not regenerate.

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4. Carbon dioxide is transported in blood mainly as:

(A) Carbaminohaemoglobin

(B) Dissolved CO_2

(C) Bicarbonate ions

(D) Carbonic acid

Correct Answer: (C) Bicarbonate ions

Solution:

Step 1: Understanding the Concept:

Carbon dioxide (CO_2) is a waste product of cellular respiration. It is transported from the tissues to the lungs through the bloodstream in three different chemical forms.

Step 2: Detailed Explanation:

The distribution of CO_2 transport is as follows:

1. **As Bicarbonate ions (HCO_3^-):** This is the major form, accounting for about 70% of CO_2 transport. Within the RBCs, CO_2 reacts with water to form carbonic acid (H_2CO_3) via the enzyme carbonic anhydrase. This acid then dissociates into bicarbonate and hydrogen ions.
2. **As Carbaminohaemoglobin:** About $20-25\%$ of CO_2 binds directly to the amino groups of the haemoglobin protein.
3. **In Dissolved Form:** About 7% of CO_2 is transported simply dissolved in the plasma.

Step 3: Final Answer:

Carbon dioxide is transported mainly in the form of bicarbonate ions.

Quick Tip: The enzyme Carbonic Anhydrase is essential for the rapid conversion of CO_2 into bicarbonate. It is found in extremely high concentrations within Red Blood Cells.

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5. The condition of reduced oxygen supply to tissues is called:

(A) Hypercapnia

(B) Hypoxia

(C) Asphyxia

(D) Cyanosis

Correct Answer: (B) Hypoxia

Solution:

Step 1: Understanding the Concept:

Medical terminology provides specific names for the status of gas levels within the blood and tissues. Reduced oxygen availability can stem from various environmental or physiological causes.

Step 2: Detailed Explanation:

1. **Hypoxia:** This term describes a condition where the oxygen supply is insufficient at the tissue level to maintain normal physiological functions.
2. **Hypercapnia:** This refers to an abnormally high level of carbon dioxide (CO_2) in the blood.
3. **Asphyxia:** A condition characterized by the severe deprivation of oxygen and an increase in carbon dioxide, often leading to unconsciousness or death.
4. **Cyanosis:** A physical sign characterized by a bluish or purplish discoloration of the skin or mucous membranes, which occurs when blood is poorly oxygenated.

Step 3: Final Answer:

Reduced oxygen supply to tissues is specifically called Hypoxia.

Quick Tip: Hypoxia can be categorized as hypoxic hypoxia (low atmospheric oxygen), anaemic hypoxia (low haemoglobin), or stagnant hypoxia (poor blood flow).

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6. Which gas has higher solubility in blood?

(A) Oxygen

(B) Nitrogen

(C) Carbon dioxide

(D) Hydrogen

Correct Answer: (C) Carbon dioxide

Solution:

Step 1: Understanding the Concept:

Solubility is the physical property of a gas to dissolve in a liquid (blood or plasma) at a constant temperature and pressure. It determines the rate of diffusion across the respiratory membrane.

Step 2: Detailed Explanation:

The solubility of carbon dioxide (CO_2) is much higher than that of oxygen (O_2).

In physiological conditions, CO_2 is approximately 20 to 25 times more soluble in blood and plasma than oxygen.

Because of this high solubility, CO_2 can diffuse across the alveolar-capillary membrane much more efficiently than oxygen, even though the partial pressure gradient for CO_2 (5 mmHg) is much smaller than for O_2 (64 mmHg).

Nitrogen and Hydrogen have very low solubility in blood at normal physiological pressures.

Step 3: Final Answer:

Among the options, Carbon dioxide has the highest solubility in blood.

Quick Tip: High solubility of CO_2 is the reason why it can be transported in significant amounts in the dissolved state in plasma compared to oxygen.

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7. The 'lub' sound of the heart is produced due to:

(A) Closing of semilunar valves

(B) Opening of AV valves

(C) Closing of AV valves

(D) Opening of semilunar valves

Correct Answer: (C) Closing of AV valves

Solution:

Step 1: Understanding the Concept:

The characteristic heart sounds ('lub' and 'dub') are mechanical vibrations created when the heart valves close to prevent the backflow of blood.

Step 2: Detailed Explanation:

The heart produces two distinct sounds during each cardiac cycle:

1. **First Heart Sound (Lub / S1):** This sound is created by the closure of the Atrioventricular (AV) valves (the Tricuspid and Mitral valves) at the start of ventricular systole. This closure prevents blood from flowing back into the atria as the ventricles begin to contract.
2. **Second Heart Sound (Dub / S2):** This sound is created by the closure of the Semilunar valves (Aortic and Pulmonary valves) at the beginning of ventricular diastole, preventing blood from flowing back into the ventricles from the arteries.

Step 3: Final Answer:

The 'lub' sound is specifically produced by the closing of the AV valves.

Quick Tip: Remember the mnemonic: "Lub-AV, Dub-SL". The 'lub' sound is lower-pitched and lasts longer than the 'dub' sound.

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8. The T-wave of an ECG indicates:

(A) Atrial contraction

(B) Ventricular contraction

(C) Ventricular repolarization

(D) Atrial depolarization

Correct Answer: (C) Ventricular repolarization

Solution:

Step 1: Understanding the Concept:

An Electrocardiogram (ECG) records the electrical impulses that travel through the heart. Each wave corresponds to a specific electrical event that triggers a mechanical action (contraction

or relaxation).

Step 2: Detailed Explanation:

A standard ECG consists of three main components:

1. **P-wave:** Represents atrial depolarization, which is the electrical signal that triggers the contraction of the atria.
2. **QRS complex:** Represents ventricular depolarization, which is the electrical signal that triggers the contraction of the ventricles (systole).
3. **T-wave:** Represents ventricular repolarization. This is the stage where the ventricular muscle cells recover from their excited state and return to their resting state, which leads to ventricular relaxation.

Step 3: Final Answer:

The T-wave is indicative of ventricular repolarization.

Quick Tip: The T-wave marks the end of the ventricular systole. If the T-wave is flat or inverted, it may indicate myocardial ischemia (lack of oxygen to the heart muscle).

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9. During ventricular systole, which valves are open?

(A) AV valves

(B) Semilunar valves

(C) Both AV and semilunar valves

(D) All valves closed

Correct Answer: (B) Semilunar valves

Solution:

Step 1: Understanding the Concept:

Ventricular systole is the phase of the cardiac cycle when the ventricles contract to pump blood out of the heart into the pulmonary and systemic circulation.

Step 2: Detailed Explanation:

The sequence during ventricular systole is as follows:

1. As the ventricles start contracting, pressure rises rapidly.
2. To prevent blood from flowing back into the atria, the Atrioventricular (AV) valves snap shut.
3. Once the pressure in the ventricles exceeds the pressure in the aorta and pulmonary artery, the Semilunar valves are forced open.
4. This allows the oxygenated blood to leave the left ventricle via the aorta and deoxygenated blood to leave the right ventricle via the pulmonary artery.

Step 3: Final Answer:

During the active ejection phase of ventricular systole, the semilunar valves are open.

Quick Tip: There is a very brief moment at the beginning of systole called "isovolumetric contraction" where all valves are closed, but the "open" state during systole refers to the ejection phase.

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10. The stroke volume of a normal human heart is approximately:

(A) 30 mL

(B) 50 mL

(C) 70 mL

(D) 100 mL

Correct Answer: (C) 70 mL

Solution:

Step 1: Understanding the Concept:

Stroke volume is the volume of blood ejected by each ventricle during a single heart beat. It is a critical measure of the heart's pumping efficiency.

Key Formula or Approach:

Stroke Volume (SV) is calculated as the difference between the End-Diastolic Volume (EDV) and the End-Systolic Volume (ESV):

$$SV = EDV - ESV$$

Step 2: Detailed Explanation:

In a healthy resting adult:

1. The End-Diastolic Volume (volume of blood in the ventricle just before contraction) is about 120 mL.
2. The End-Systolic Volume (volume of blood remaining after contraction) is about 50 mL.
3. Therefore: $SV = 120 \text{ mL} - 50 \text{ mL} = 70 \text{ mL}$.

This means that in every beat, each ventricle pumps out about 70 mL of blood.

Step 3: Final Answer:

The approximate stroke volume is 70 mL.

Quick Tip: Cardiac Output (CO) is Stroke Volume (70 mL) multiplied by Heart Rate (72 bpm), which equals roughly 5040 mL/min or 5 liters per minute.
