

# GUJCET 2024 Biology Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :120	Total Questions :120
-----------------------	--------------------	----------------------

## General Instructions

**Read the following instructions very carefully and strictly follow them:**

1. The Duration of test is 3 Hours.
2. This paper consists of 120 Questions.
3. There are three parts in the paper consisting of Physics, Chemistry and Mathematics having 40 questions in each part of equal weightage..
4. Physics and Chemistry - 40 Questions each.
5. Mathematics / Biology - 40 Questions
6. Choice and sequence for attempting questions will be as per the convenience of the candidate.
7. Determine the one correct answer out of the four available options given for each question.
8. Each question with correct response shall be awarded one (1) mark. 0.25 marks will be deducted for every wrong answer.

## Biology

**1. Which of the following sexually transmitted infections are spread by other means besides sexual intercourse?**

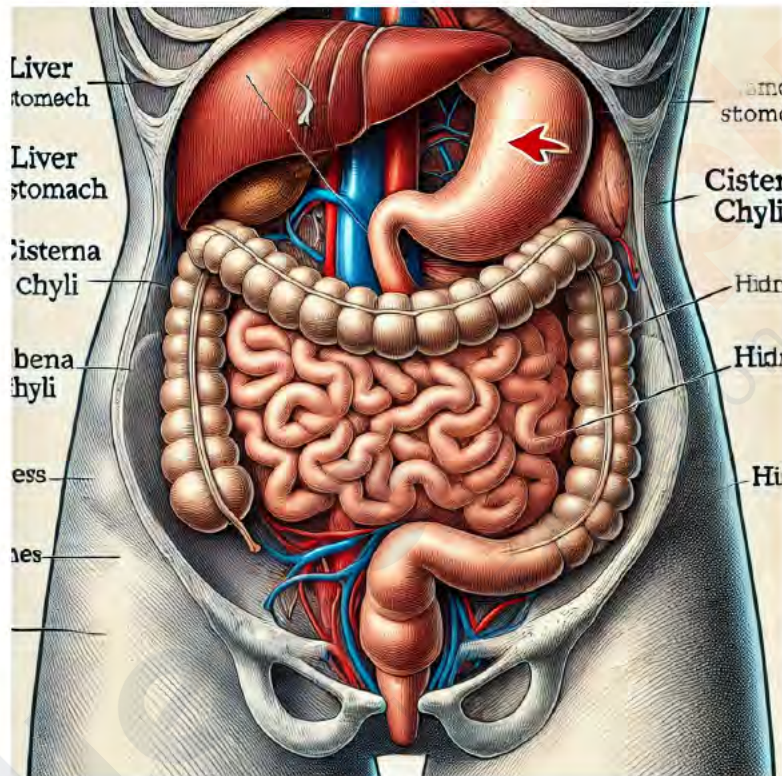
**Correct Answer:** Hepatitis - B

**Solution:** Hepatitis B is a viral infection that is primarily transmitted through sexual contact, but it can also be spread through other means such as: - Contact with infected blood (e.g., sharing needles or other drug paraphernalia). - From mother to child during childbirth. - Exposure to contaminated blood products.

### Quick Tip

Hepatitis B is one of the few sexually transmitted infections that can be transmitted through other means such as blood transfusions and shared needles. Always ensure safe practices to prevent such infections.

## 2. What does the pointed 'X' in the figure below represent?



**Correct Answer:** Tumbaika

**Solution: Step 1: Understanding the anatomical structure.** The term "Tumbaika" refers to the cisterna chyli, a major lymphatic structure in the body. It is an elongated sac-like structure located in the abdomen, serving as the origin of the thoracic duct.

**Step 2: Function of the cisterna chyli.** The cisterna chyli collects lymph from the lower limbs, pelvis, and abdomen and then drains it into the thoracic duct, which eventually empties into the venous circulation.

**Step 3: Identifying 'X' in the diagram.** In the given anatomical diagram, the pointed 'X' corresponds to the cisterna chyli (Tumbaika) in the lymphatic system, highlighting its crucial role in lymph drainage.



**Conclusion:** The pointed 'X' in the figure represents Tumbaika (Cisterna Chyli), which is an essential component of the lymphatic system.

**Quick Tip**

The cisterna chyli is the largest lymphatic reservoir in the body. It plays a key role in the immune and circulatory systems by transporting lymph from the lower body to the thoracic duct.

**3. On which chromosome of each parent is the gene controlling  $\beta$ -thalassemia located?**

**Correct Answer:** 11th chromosome

**Solution:** The gene responsible for  $\beta$ -thalassemia is located on the 11th chromosome. It is a genetic disorder that is inherited in an autosomal recessive manner, meaning both copies of the gene, one from each parent, must be mutated for the individual to exhibit the disease.

**Quick Tip**

The  $\beta$ -thalassemia gene is located on the 11th chromosome. This information is critical when studying genetic inheritance patterns in thalassemia.

**4. In in vitro fertilization, the process in which more than 8-celled embryos are transferred to the uterus to complete further development is called what?**

**Correct Answer:** IUT

**Solution:** In in vitro fertilization (IVF), the process where more than 8-celled embryos are transferred to the uterus for further development is known as Intrauterine Transfer (IUT). This method is used to increase the chances of successful implantation and pregnancy.

**Quick Tip**

In IVF, the transfer of embryos at the appropriate developmental stage can improve the chances of pregnancy. IUT is performed when embryos have developed to a stage where they can implant in the uterus.

**5. If mother's blood group is 'A' and father's blood group is 'O', then what can be the blood group of their child?**

**Correct Answer:** A or O

**Solution:** Blood groups are inherited from both parents. The mother with blood group 'A' can have either genotype 'AA' or 'AO', while the father with blood group 'O' must have genotype 'OO'. - If the mother passes on the 'A' allele and the father passes on the 'O' allele, the child will have blood group 'A'. - If the mother passes on the 'O' allele and the father passes on the 'O' allele, the child will have blood group 'O'. Thus, the possible blood groups for the child are 'A' or 'O'.

**Quick Tip**

When determining possible blood groups, consider both the alleles from each parent. A mother with blood group 'A' may pass either an 'A' or an 'O' allele, while a father with blood group 'O' will always pass an 'O' allele.

---

**6. "The fetus never passes through the adult stages of other animals", Who said this statement?**

**Correct Answer:** Carl Ernst von Bayer

**Solution:** The statement "The fetus never passes through the adult stages of other animals" was made by Carl Ernst von Bayer, a German biologist. He emphasized the concept that embryonic development in animals does not necessarily mirror the adult forms of other species, highlighting a unique aspect of fetal development.

**Quick Tip**

This principle relates to von Bayer's law of embryology, which suggests that embryos of different species follow their own developmental paths and do not replicate the adult forms of other species during their fetal stages.

---

**7. Which of the following is an example of function membership?**

**Correct Answer:** Sweet potatoes and potatoes



**Solution:** Function membership refers to the classification of organisms or items that belong to a certain category based on their function or characteristics. In this case, sweet potatoes and potatoes are both examples of root vegetables, fulfilling similar functions in terms of nutrition and culinary uses, thus they are considered as examples of function membership.

#### Quick Tip

Function membership classifies organisms or items based on their shared characteristics or uses, such as sweet potatoes and potatoes being functionally similar as root vegetables.

### 8. Which of the following does not affect the Hardy-Weinberg equilibrium?

**Correct Answer:** Adaptive diffusion

**Solution:** The Hardy-Weinberg equilibrium states that allele frequencies in a population will remain constant from generation to generation in the absence of evolutionary influences. Factors such as mutation, genetic drift, migration, non-random mating, and natural selection can affect this equilibrium. However, adaptive diffusion, which refers to the spread of advantageous traits within a population, does not directly influence the equilibrium, as it is more related to natural selection and migration rather than the equilibrium conditions.

#### Quick Tip

Remember, the Hardy-Weinberg equilibrium is maintained only when no evolutionary forces are at play. Adaptive diffusion is related to the spread of traits due to selection, not a direct disruptor of equilibrium.

### 9. How many types of receptors are present in a cell?

**Correct Answer:** 61

**Solution:** In a typical cell, there are 61 different types of receptors. These receptors are specialized proteins located on the cell membrane or within the cell, which respond to specific stimuli such as hormones, neurotransmitters, and other signaling molecules. The number of receptor types can vary depending on the cell's function, but 61 types are



commonly identified across various cell types.

#### Quick Tip

Receptors are essential for cellular communication, enabling cells to respond to a wide variety of signals. Each receptor type is specific to its corresponding ligand.

**10. If a double-stranded DNA contains 30% adenine, state the percentage of cytosine in the same DNA.**

**Correct Answer:** 20%

**Solution:** In double-stranded DNA, the base pairing rule states that adenine (A) pairs with thymine (T), and cytosine (C) pairs with guanine (G). According to Chargaff's rule, the percentage of adenine equals the percentage of thymine, and the percentage of cytosine equals the percentage of guanine. Given that the DNA contains 30% adenine, it must also contain 30% thymine. This leaves 40% of the DNA to be divided equally between cytosine and guanine, resulting in 20% cytosine and 20% guanine.

#### Quick Tip

Use Chargaff's rule to determine the percentages of complementary base pairs. If adenine is 30%, thymine will also be 30%, and the remaining 40% is split equally between cytosine and guanine.

**11. Based on which of the following symptoms, doctor 'X' will diagnose the patient with pneumonia?**

**Correct Answer:** Lips and fingernails have turned gray and blue.

**Solution:** One of the key symptoms of pneumonia is the lack of sufficient oxygen in the blood, which can cause the lips and fingernails to appear gray or blue, a condition known as cyanosis. This occurs when the lungs are unable to effectively oxygenate the blood due to infection or inflammation. Cyanosis is a significant indicator for doctors to suspect pneumonia.

### Quick Tip

In cases of pneumonia, look for signs of poor oxygenation like cyanosis (bluish tint to lips and fingernails), which indicates a possible respiratory failure.

## 12. Which of the following groups is included in the secondary lymphatic organs?

**Correct Answer:** Segments of duodenum, tonsils, small intestine pairs

**Solution:** Secondary lymphatic organs are involved in the activation and response of the immune system. These include structures like the tonsils, spleen, lymph nodes, and mucosal-associated lymphoid tissues (MALT). Segments of the duodenum and pairs of lymphatic tissues in the small intestine (such as Peyer's patches) are examples of MALT, which function as secondary lymphatic organs.

### Quick Tip

Secondary lymphatic organs are where immune cells are activated, and include the tonsils, spleen, and MALT like Peyer's patches in the small intestine.

## 13. What is cirrhosis?

**Correct Answer:** Liver disease caused by excessive alcohol addiction.

**Solution:** Cirrhosis is a progressive liver disease where healthy liver tissue is replaced by scar tissue, impairing the liver's ability to function. One of the leading causes of cirrhosis is excessive alcohol consumption over an extended period. Chronic alcohol abuse can lead to liver damage, resulting in cirrhosis.

### Quick Tip

Cirrhosis is commonly caused by chronic alcohol use, which leads to liver damage and the formation of scar tissue. Early detection is crucial to manage the condition.

## 14. Which of the following statements is correct?

1. (i) Baculoviruses are considered best members for species-specific, short-spectrum



insecticide applications.

2. (ii) *Bacillus thuringiensis* is used to control butterfly caterpillars.
3. (iii) Use of ladybirds is very beneficial in getting rid of mosquitoes.
4. (iv) *Trichoderma* fungi are used in the treatment of diseased animals under biocontrol.

**Correct Answer:** (i) and (ii)

**Solution: Step 1:** Baculoviruses are indeed species-specific and have a narrow host range, making them effective for use in short-spectrum insecticide applications. This is a correct statement.

**Step 2:** *Bacillus thuringiensis* (Bt) is a bacterium that produces toxins harmful to certain insects, including butterfly caterpillars. Hence, statement (ii) is also correct.

**Step 3:** Statement (iii) is incorrect as ladybirds are beneficial in controlling aphids and other pest insects, not mosquitoes.

**Step 4:** *Trichoderma* fungi are used in biocontrol, but primarily for controlling plant pathogens, not for treating diseased animals. Therefore, statement (iv) is incorrect.

#### Quick Tip

For biocontrol, it's important to match the biological agent with its specific target species for effective control.

---

**15. DNA polymerase isolated from which of the following bacteria is used in PCR method?**

**Correct Answer:** *Thermus aquaticus*

**Solution:** DNA polymerase used in the Polymerase Chain Reaction (PCR) method is isolated from the bacterium *Thermus aquaticus*. This bacterium thrives in high-temperature environments, and its polymerase enzyme, known as Taq polymerase, is heat-stable, making it ideal for the repeated heating and cooling cycles required in PCR.



### Quick Tip

Taq polymerase from *Thermus aquaticus* is essential for PCR because of its heat resistance, allowing it to remain active during the high temperatures used in the process.

### 16. ELISA method works on which of the following principles?

**Correct Answer:** Antigen-antibody interactions

**Solution:** The ELISA (Enzyme-Linked Immunosorbent Assay) method works on the principle of antigen-antibody interactions. In this method, an antigen is attached to a surface, and a specific antibody is used to bind to the antigen. The antibody is linked to an enzyme, and the enzyme reacts with a substrate to produce a detectable signal, often in the form of color change, indicating the presence of the antigen.

### Quick Tip

ELISA is based on the specific binding between antigens and antibodies, making it a highly sensitive method for detecting specific molecules like proteins, hormones, or pathogens.

### 17. $\alpha$ -1 antitrypsin is used to treat which disease?

**Correct Answer:** Emphysema

**Solution: Step 1: Understanding  $\alpha$ -1 antitrypsin and its role.**  $\alpha$ -1 antitrypsin (AAT) is a protein primarily produced in the liver. It protects the lungs from damage caused by enzymes such as neutrophil elastase, which can degrade elastin in the alveoli. Elastin is essential for maintaining the structural integrity and elasticity of the lungs.

**Step 2: Relation to emphysema.** Emphysema, a chronic obstructive pulmonary disease (COPD), occurs when the alveoli in the lungs are damaged, leading to breathing difficulties. In individuals with  $\alpha$ -1 antitrypsin deficiency, the unchecked activity of neutrophil elastase accelerates alveolar damage, contributing to the development of emphysema. Administering  $\alpha$ -1 antitrypsin helps restore the protective balance, slowing disease progression.

**Conclusion:**  $\alpha$ -1 antitrypsin is specifically used to treat emphysema in patients with AAT



deficiency.

#### Quick Tip

$\alpha$ -1 antitrypsin deficiency is a genetic condition. Early diagnosis and treatment with AAT therapy can prevent severe lung damage in affected individuals.

### 18. In which mechanism specific mRNA is inactivated after binding to complementary dsRNA?

**Correct Answer:** RNAi

**Solution:** RNA interference (RNAi) is a biological mechanism in which specific mRNA molecules are inactivated after binding to complementary double-stranded RNA (dsRNA). This process leads to the degradation of the mRNA or inhibition of its translation, thus preventing the expression of the corresponding gene.

#### Quick Tip

RNAi is a powerful mechanism for regulating gene expression by targeting and silencing specific mRNA molecules, often used for gene knockdown in research.

### 19. Which naturalist gives an explanation of species-territory relationships?

**Correct Answer:** Alexander von Humboldt

**Solution:** Alexander von Humboldt, a renowned naturalist, is known for his work on the relationship between species distribution and geographical factors. He explained how the variety of species in an area is influenced by the environmental conditions and the territory's physical features, contributing to our understanding of biogeography.

#### Quick Tip

Humboldt's exploration of species-territory relationships laid the foundation for modern biogeography, showing how environmental factors determine species distribution.

### 20. What interaction occurs between oceanic and cloven fish?



**Correct Answer:** Cohabitation

**Solution:** Cohabitation is the interaction between oceanic fish and cloven fish where both species live in close proximity, often sharing the same habitat without directly competing for resources. This mutual arrangement allows both species to coexist peacefully, benefiting from the shared environment.

**Quick Tip**

Cohabitation refers to species living together in the same habitat, often without direct competition, allowing for a peaceful coexistence.