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| **PB1/BIAK/1223/A 23-NOV-2023** | | |
| **PRE-BOARD EXAMINATION I -(2023-24)**  **ANSWER KEY** | | |
|  | **SECTION A** | 1\*16 |
|  | d- All the above | |
| 2 | **c.**Gonorrhea, hepatitis B, chlamydiosis | |
| 3 | b. Suspect 2 | |
| 4. | c. 2 = Liver, 4 = RBC. (a) Plasmodium falciparum. (b) Mosquito control: i. Avoid stagnation of water. ii. Use mosquito nets. | |
| 5. | b-i&iv | |
| 6. | b. Incubation period | |
| 7. | a-E. coli | |
| 8 | c- Polypeptide chain C | |
| 9 | a- Competition | |
| 10 | d- Both b and c | |
| 11 | a-Convergent evolution | |
| 12 | a- Small population | |
|  | *Question No. 13 to 16 consists of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:*  *a) Both A and R are true, and R is the correct explanation of A.*  *b) Both A and R are true, and R is not the correct explanation of A.*  *c) A is true but R is false.*  *d) A is false but R is true.* |  |
| **13** | **(c)**A is true but R is false. | 1 |
| **14** | (a) Both Assertion and Reason are correct, and Reason is the correct explanation for Assertion. | 1 |
| **15** | **(b)**If both Assertion and Reason are true but the reason is not the correct explanation of the assertion | 1 |
| **16** | (c) Assertion is true, but the reason is false | 1 |
|  | **SECTION B** | 2\*5 |
| **17.** | i-Which hormone is responsible for development from q to e?  i- FSH (follicular stimulating hormone)3-(1)  ii- Identify the role of g and mention its role.  ii-Corpus luteum releases progesterone which is responsible for the maintenance of the  endometrium lining of the uterus.(1) | 2 |
| **18.** | Ans: i-(1)    ii-when parents are homozygous for blood group O -(1) | 2 |
| **19** | A virus with RNA instead of DNA as its genetic material is known as a retrovirus. It  uses an enzyme to become part of the host cell’s DNA.  i-Give an example of a pathogenic retrovirus.   1. HIV (1)   ii- Retrovirus are RNA viruses. Name the process and enzyme which help these to  make DNA.  ii- Process- Reverse transcription (1/2)  Enzyme: Reverse transcriptase (1/2) | 2 |
| **20** | Ans: DNA is negatively charged, therefore, when an electric current is applied to the gel, DNA will migrate towards the positively charged electrode. Shorter strands of DNA move more quickly through the gel than longer strands resulting in the fragments being arranged in order of size. (1)  b) Agarose is a polysaccharide, generally extracted from certain red seaweed. Agarose is frequently used in molecular biology for the separation of molecules, especially DNA, by electrophoresis. (1) | 2 |
| **21** | i- Type of selection is different as A is (1)  stabilizing selection and C is disruptive selection.  ii- The directional selection is applied to a population over time, the selected. (1)  traits will increase, while the traits selected against will be lost | 2 |
|  | **SECTION -C** | 3\*7 |
| **22.** | **Ans:** a- Meiosis / reductional division-(1)  b- Haploid (n)-(1)  c- Synergids, egg cells and antipodals are haploid cells in an unfertilized mature embryo-sac. (1/2)  The total number of cells are 7 (3 antipodals, 2 synergids, 1 egg cell, 1 central cell).(1/2) | 3 |
| **23.** | a- What is ART?   1. ART includes all fertility treatments in which either eggs or embryos are handled. In general, ART procedures involve surgically removing eggs from a woman's ovaries, combining them with sperm in the laboratory, and returning them to the woman's body or donating them to another woman.(1) 2. Identify the following techniques.   i-Transfer of an ovum collected from a donor into the fallopian tube of another female who is unable to produce. -**GIFT** (1)  The process in which sperm is directly injected into the ovum.  ii-**CSI** is intra cytoplasmic sperm injection. It is one of the techniques of Assisted Reproductive Technology (ART) that helps couples to overcome their infertility. (1) | 3 |
| **24.** | **Ans:** i- A - DNA template strand B - Coding strand of DNA, C – newly synthesized  RNA, D – enzyme RNA-polymerase, E - rho (p) factor (1)  ii-Sigma factor (1)  iii-Splicing (1) | 3 |
| **25.** | Stanley Miller and Harold C. Urey (1953) tried to recreate the conditions that might have  existed on the primitive atmosphere. For that, they had prepared the apparatus i.e., glass tubes and glass chambers which were fitted tightly as shown in the diagram.  i- What was the mixture of gases used in chamber marked A?  CH4 , NH3, H2 and H2O  ii- At what conclusion did Miller arrive after his experiment?  . The classic Miller-Urey experiment demonstrated that amino acids, important building blocks of biological proteins, can be synthesized using simple starting materials under simulated prebiotic terrestrial conditions.  iii- The category of molecules produced by the Miller-Urey experiment was\_**organic monomers.** | 3 |
| **26** | Some important drugs are isolated by using microbes. One such drugs is used in lowering.  cholesterol. The chemical structure of the statin is given below.  i-Name the organism which is used in the production of statin.  Statins are produced by yeasts named Monascus purpureus.  ii.Give another example of a product that is synthesized by microorganisms and used in  medical science.  Cyclosporin-A is utilized as an immunosuppressant in organ transplant patients.  and is synthesized by the fungus Trichoderma polysporum.  iii.In which part of plant nicotine is formed?  OR  a. Name the disease caused by *Haemophilus influenzae-* **Meningitis.**  b. Name the organ infected and the effect of infection.  H. influenzae can invade the fluid around the spine and brain, causing meningitis, or bloodstream, causing bacteremia. Invasive disease is usually serious, requiring treatment in a hospital, and can sometimes result in death.  c.Write about the symptoms of the disease.   * Fever. * Headache. * Stiff neck. * Nausea with or without vomiting. | 3 |
| **27** | A cloning vector is a small piece of DNA that can be stably maintained in an organism,  and into which a foreign DNA fragment can be inserted for cloning purposes. A large  number of cloning vectors are available, and choosing the vector may depend upon a  number of factors, such as the size of the insert, copy number and cloning method.   1. EcoRI is a restriction enzyme that derives its name from the bacterium Escherichia coli.   ii)Why ampR is used in this?  Pseudomonas aeruginosa AmpR is a global transcriptional factor that regulates expression of AmpC and PoxB β-lactamases, proteases, quorum sensing, and other virulence factor.  iii)What is rop?  Repressor of primer (Rop) is a small dimeric protein that participates in the mechanism that controls the copy number of plasmid of the ColE1 family by increasing the affinity between two complementary RNAs. | 3 |
| **28** | Ans:  i- a-Sludge b- gas holder c- slurry water/dung water  ii- contains Methanobacterium  iii- methane gas is produced by Methanobacterium | 3 |
|  | **SECTION -D** | 4\*2 |
|  | Q. No. 29 and 30 are case-based questions which has 3 subparts with internal choice in one subpart. |  |
| 29. | Ans: Hay fever, asthma  iii) Which plant from the list does not cause pollen allergy?   1. Chenopodium 2. Rose   (b)Rose  (iv) The function of germ pore in pollen grain is  (a) Emergence of radicle  (b) Absorption of water for seed germination  (c) Initiation of pollen tube  (d) All of these  Assertion- Sporopollenin is an oxidative polymer of carotenoids which helps in fossilization.  Reason- Sporopollinin is a tough substance that provides resistance to biological decomposition, high temperature and alkali.  (a) Both assertion and reason are true, and reason is the correct explanation of assertion.  (b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.  (c) Assertion is true, but reason is false.  (d) Both assertion and reason are false. | 4 |
| 30 | a) 'r ' represents the 'intrinsic rate of natural increase'.  (b) It is an important parameter for assessing the impacts of any biotic and abiotic factor on population growth.  (c) The birth rate is 20/100 or 0.5/frog/year. | 4 |
|  | **SECTION -E** | 3\*5 |
| **31** | The given diagram is related to the oogenesis process in human females.   1. Label ‘A’, ‘B’ and ‘C’ in the diagram. Write the significance of ‘C’.   A-Mitotic differentiation  B-Secondary Oocyte  C-Second Polar body. Most of the cytoplasm is retained by the mature egg (ovum), and a second polar body receives little more than a haploid nucleus.   1. How many ovum is produced from one ovary?   The eggs/ova are only developed once every menstrual cycle (e.g. once a month in humans). So 12 ova will be produced in a year(12 months) considering 12 menstrual cycles occur each year. But since human females have 2 ovaries that produce eggs 'alternatively', only 6 eggs will be produced by an ovary in a year.   1. Why is fetal life shown in the diagram while ovum release is related to the puberty period?   The process of oogenesis starts in the fetal ovaries with the development of oogonia from primordial germ cells (PGCs). Each oogonium in the fetal ovaries divides and enters the initial stage of meiosis (meiosis I) to become the diploid primary oocyte.  **OR**  With the help of a labeled diagram describe the structure of mammary gland the characteristic of all female mammals.  .  A functional mammary gland is characteristic of all female mammals. The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat. The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli (Figure 3.4). The cells of alveoli secrete milk, which is stored in the cavities (lumens) of alveoli. The alveoli open into mammary tubules. The tubules of each lobe join to form a mammary duct. Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct through which milk is sucked out.  (3+2) | 5 |
| **32** | Explain the packaging of DNA helix.   1. In Prokaryotes 2. In Eukaryotes   **OR**   1. A molecule that can act as a genetic material must fulfill certain criteria. Which are they? 2. The genetic material should be stable enough not to change with different stages of life cycle, age or with change in physiology of the organism. Comment on the stability of genetic material and prove that DNA is a better genetic material.   Which experiment is an additional proof for the stability of DNA.  Explain the packaging of DNA helix  a) In Prokaryotes  b) In Eukaryotes  a) In prokaryotes, such as, E. coli, though they do not have a defined nucleus, the DNA is not scattered throughout the cell. DNA (being negatively charged) is held with some proteins (that have positive charges) in a region termed as ‘nucleoid’. The DNA in nucleoid is organised in large loops held by proteins(2)  b) In eukaryotes, this organisation is much more complex. There is a set of positively charged, basic proteins called histones. A protein acquires charge depending upon the abundance of amino acids residues with charged side chains. Histones are rich in the basic amino acid residues lysine and arginine. Both the amino acid residues carry positive charges in their side chains. Histones are organised to form a unit of eight molecules called histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome (Figure 5.4 a). A typical nucleosome contains 200 bp of DNA helix. Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin, threadlike stained (coloured) bodies seen in nucleus. The nucleosomes in chromatin are seen as ‘beads-on-string’ structure(3)  **OR**  a) A molecule that can act as a genetic material must fulfill certain criteria. Which are they?  A molecule that can act as a genetic material must fulfill the following criteria: (i) It should be able to generate its replica (Replication). (ii) It should be stable chemically and structurally. (iii) It should provide the scope for slow changes (mutation) that are required for evolution. (iv) It should be able to express itself in the form of 'Mendelian Characters’.(2)  b) The genetic material should be stable enough not to change with different stages of life cycle, age or with change in physiology of the organism. Comment on the stability of genetic material and prove that DNA is a better genetic material.  This now can easily be explained in light of the DNA that the two strands being complementary if separated by heating come together, when appropriate conditions are provided. Further, 2'-OH group present at every nucleotide in RNA is a reactive group and makes RNA labile and easily degradable. RNA is also now known to be catalytic, hence reactive. Therefore, DNA chemically is less reactive and structurally more stable when compared to RNA. Therefore, among the two nucleic acids, the DNA is a better genetic material. (2)  c)Which experiment is an additional proof for the stability of DNA. Griffith Experiment (1)  Stability as a property of genetic material was clearly demonstrated in Griffith's transforming principle, which said that heat, which killed bacteria, did not destroy certain of the qualities of genetic material. | 5 |
| **33** | a-Give a brief description of the role of DNA-dependent DNA polymerase.  b- Why Okazaki fragments are formed in short fragments?  c- Write two roles of dNTPs.  **OR**  DNA fingerprinting is used in a variety of situations, such as criminal investigations, other forensic purposes, and paternity testing. In these situations, one aims to “match” two DNA fingerprints with one another, such as a DNA sample from a known person and one from an unknown person. (Source: National Human Genome Research Institute)  i)What does ‘A’ represent?  ii)What is the basis of DNA fingerprinting?  iii) What is the use of autoradiography in DNA fingerprinting?  iv) Of the total base sequence present in humans   1. 99.9% of all human beings are identical. 2. % of all human beings are identical. 3. 100 % different 4. No difference is observed till no   **v**) List the various markers that are used in DNA fingerprinting.  a-DNA-dependent DNA polymerases are responsible for directing the synthesis of new DNA from deoxyribonucleotide triphosphates (dNTPs) opposite an existing DNA template, which contains the genetic information critical to an organism's survival (2)  b- Because DNA polymerases cannot initiate DNA synthesis, each Okazaki fragment is primed with a short RNA. (1)  c- i-Deoxynucleoside triphosphate is a nucleotide containing 3 phosphate groups attached to the 5' carbon of the deoxyribose sugar of the nucleoside. It has mainly two roles: They are the building blocks of the DNA strand. They also serve as the energy provider in the form of GTP and ATP (2)  OR  a) DNA Fingerprinting autoradiography (1)  b) The basis of DNA fingerprinting is VNTR. VNTR is a satellite DNA as a probe showing a high degree of polymorphism. This implies that there are repetitive sequences of DNA that are found across individuals of all species. Scientists identify variations in these sequences. (1)  c) Autoradiography is a photographic method used to detect radioactive materials, among them radiolabeled proteins that are resolved by 2-DE, since autoradiography energy is able to penetrate through the gel and onto the photographic film. (1)  iv) a-99.9% of all human beings are identical (1)  v)Markers in DNA fingerprinting are DNA sequences that can be used for the identification of an individual's DNA. These markers will show DNA polymorphism and repetitive sequences.(1) | 5 |

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