

Solution PRACTICE Paper 01 (2020-21)

Class 12

Biology

Section A (1 mark each)

1. The zygote stage is the stage at which meiosis occurs in organisms with the haploid life cycle. The zygote divides by meiosis to form the haploid spores which then grow into the haploid organisms.
2. 40 sperms. 10 eggs.
Henking first observed the X-chromosome and he called it as X body.
4. In ET (embryo transfer) technique, an embryo of 8 cell stage or lesser is transferred to be fallopian tube (zygote intrafallopian transfer) while that of more than 8 blastomere stage is transferred to the uterus (intrauterine transfer).
5. increase in 'r' increases the population size while decrease in 'r' decreases the population size.
6. In codominance, alleles are able to express themselves independently when present together. Thus, in a monohybrid cross showing codominance, there would be three kinds of phenotypes in the F₂-generation.
7. Two contrasting flower traits are
 - i. Violet flowers and white flowers.
 - ii. Axial flowers and terminal flowers.
- 8.(i) Sporozoite
(ii) Gametocyte
9. Polymerase chain reaction (PCR) is a technique used in molecular biology to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.
10. *Saccharomyces cerevisiae*. It enhances vitamin B12.
11. (a) The assertion is a true statement but the reason is false.

Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

- (a) Both assertion and reason are correct

Explanation:

- o In human beings, 23 pairs of chromosomes are present in diploid cells.
- o 22 pairs of chromosomes are equal in male and female but a pair sex chromosome is different in them. Male contains XY and females contain XX sex chromosomes.

12. (a) Both Assertion and Reason are false

Explanation: interferons are a group of signaling proteins made and released by host cells in response to the presence of pathogens to increase antiviral defense. It does not stimulate inflammation at the site of injury.

13. (a) Both Assertion and Reason are true

Explanation: Synthesis of RNA from DNA is called transcription and it occurs in the nucleus of eukaryotic cells.

DNA replication occurs in the cytoplasm of prokaryotes and in the nucleus of eukaryotes. Regardless of where DNA replication occurs. The basic process is the same.

Synthesis of protein from RNA is called translation and it occurs in the cytoplasm of eukaryotic cells.

Messenger RNA (mRNA) is a molecule in cells that carries codes from the DNA in the nucleus to the sites of protein synthesis in the cytoplasm (ribosomes) where they can be joined together in specific order to make a specific protein.

14. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation: Although India has only 2.4 percent of the world's land area, its share of the global species diversity is an impressive 8.1 percent. That is that makes our country one of the 12 mega diversity countries of the world. Nearly 45,000 species of plants and twice as many animals have been recorded from India. Applying this proportion to India's diversity figures, we estimate that there are probably more than 1,00,000 plant species and more than 3,00,000 animal species yet to be discovered and described.

15.i. (d) competition

ii. (d) All of these

iii. (d) commensalism

iv. (c) Bacteria decomposing organic matter

v. (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion

16. i. (b) groundnut

ii.(a) micropyl

iii. (b)dormancy

iv.(b) pericarp

v.(d) false fruit of strawberry

17. (i) Maternal mortality rate

(ii) In vitro fertilization

(iii) Gamete intra fallopian transfer

- (iv) Assisted reproductive technologies.

Section -B (2 marks each)

18. The genes for color blindness are present on the X chromosome. But X chromosome in a son (male child) is not contributed by the father but comes from the mother. Hence, even if a father and his son both are suffering from color blindness, the son has inherited this trait from his mother.

19. Azotobacter is a free-living nitrogen-fixing bacterium. It fixes atmospheric nitrogen in the soil and increases the fertility of soil. Maize plants cultivated in fertile soil result in the increase in yield.

20. There are two advantages -
(i) Any gene can be used for transfer.
(ii) Change in genotype is precisely controlled.

OR

ELISA-Enzyme Linked Immunosorbent Assay. ELISA is based on antigen-antibody interaction. The two ways to detect the presence of infection or disease by ELISA are as follows:

- i. The presence of antigens (proteins, glycoproteins, etc.) is detected.
ii. ii Antibodies produced against the pathogens are detected.

21.
(i) DNA -DNA -----REPLICATION
(ii) DNA — hnRNA-----EUKARYOTIC TRANSCRIPTION
(iii) hnRNA-Protein-----TRANSLATION
(iv) Repressor Protein + Operator-----NO TRANSCRIPTION-----GENE REGULATION

22.*The separated DNA fragments can be visualized after staining with ethidium bromide followed by exposure to UV radiation.

*Elution- It is cutting and extraction of desired DNA bands from agarose gel to get its purified form.

OR

The basic definition of biotechnology says is a set of methods to use live organisms to produce products and processes for the benefit of humankind. So, it is correct to include a winemaker, as well as a molecular biologist under the category of biotechnologies as one has developed a recombinant vaccine and the other has developed wine using living organisms for human welfare.

23. Scientists have yet to understand the proper cause for the large-scale extinction of amphibians. Some of the possible reasons are disease, habitat destruction and modification, exploitation, pollution, pesticide use, exotic species, and ultraviolet-B radiation. Small populations that survive within small fragments are often susceptible to inbreeding, genetic drift, or extinction due to small fluctuations in the environment. Their complex reproductive need may be one of the causes of the high vulnerability of amphibians to extinction.

24. Herbivores are considered similar to predators in iconological context because they transfer the energy fixed by plants to the next tropic level of carnivores. They also maintain the plant population under control.

25. International Union of conservation of Nature and Natural Resources. The IUCN is a union consisting of environmental experts and scientists from 160 countries. Its purpose is to preserve nature and seek solutions for the most urgent environmental problems.

Section C (3 marks each)

26. GENOTYPE

PHENOTYPE

It is the external manifestation of gene products brought to expression.	It is the gene complement/gene makeup of an individual.
The phenotype may change with time and environment e.g., young and old man.	Genotype remains the same throughout the life of an individual.
The phenotype can be known through direct observation.	Genotype cannot be studied directly. It can be known through the study of ancestors, mating or offspring.
Genotype establishes the boundaries within which phenotype can be expressed.	It is not influenced by phenotype.

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Individuals with similar phenotypes may not belong to the same genotype.	In a given environment or time, individuals with similar genotypes will produce similar phenotypes.
Individuals with different phenotypes usually have different genotypes.	Individuals with different genotypes may have similar phenotype e.g., tallness for TT and Tt.

27. Lac operon is shut down after some times when the added lactose is utilized from the medium. It is because the repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon.

28. Passive smoking is definitely more dangerous than active smoking. A smoker is aware about the dangers of smoking and is doing it deliberately. But a non-smoker does not do it deliberately but situations force him/her to inhale the smoke. Epidemiological data show a higher prevalence of smoking-related diseases in smokers but still passive smoking is more dangerous because of the non-intention factor evolved in it.

29.i NH₄Cl ammonium chlorides.

ii. The heavy and light DNA molecules can be differentiated by centrifugation in a cesium chloride (CsCl) density gradient. The N¹⁵- DNA was heavier than N¹⁴-DNA and the hybrid N¹⁵-N¹⁴ DNA has a density intermediate of the two.

iii. Scientists concluded that the DNA replication is semiconservative, i.e., of the two strands of DNA, one is the parental strand. while another is newly synthesized.

30.

Pneumonia	common cold
Infected alveoli of lungs	Infected nose & respiratory

	passage instead of lungs
fever, chills	Nasal congestion and discharge, sore throat
Lips /fingers may turn grey to black in severe case	Lips/fingers are not affected in case of common cold

OR

Morphine is an opioid drug. Its source plant is *Papaver somniferum*.

- These drugs bind to specific opioid receptors present in central nervous systems and gastrointestinal tract and slow down the body functions

Section D (5 marks each)

31. i Stage 'g' represents the developing corpus luteum. Luteinizing hormone (LH) secreted by pituitary help in its formation.

ii. The corpus luteum secretes a large amount of hormone progesterone. It is essential for the maintenance of the endometrium of the uterus. It is a necessity for implantation and for pregnancy,

iii. Stage 'd' represents the tertiary follicle with a small cavity-antrum. It is surrounded by many layers of granulosa cells. It contains primary oocyte (meiosis-I arrested at prophase-I stage V represents the mature follicle called Graafian follicle with a fluid- filled cavity antrum. It contains a secondary Oocyte and a tiny first polar body.

The mature follicle is surrounded by theca externa and theca interna. It bursts to release secondary oocyte (Ovulation)

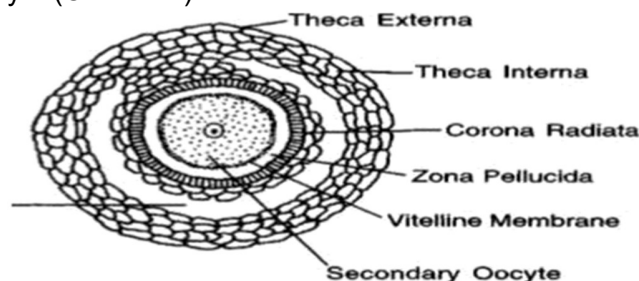


Figure: Structure of a mature oocyte

OR

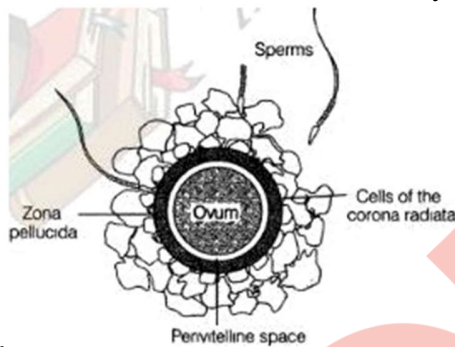
i. fertilisation is the process of fusion of a sperm with an ovum. The following events of fertilisation and implantation in an adult human female are as follows-

a. The motile sperms move through the cervix, enter the uterus and reach the junction of the isthmus and ampulla (ampullary-isthmic junction) of the fallopian tube.

b. The ovum released from the ovary also reaches the ampullary isthmic junction, Where fertilization takes place.

fertilisation can only occur if the ovum and sperms are transported simultaneously to this junction. This explains why all copulations do not lead to fertilisation and pregnancy,

d. The sperm comes in contact with the zona pellucida of the ovum and induces changes in the membrane, which blocks the entry of the other sperms. Thus, it ensures that only one of the sperm can fertilize an ovum. i.e., secondary oocyte.



e.

During Implantation the mitotic division starts as the zygote moves through the isthmus of the oviduct towards the uterus called cleavage, forming 2, 4, 8, 16 daughter cells called blastomeres.

i. The embryo with 8-16 blastomeres is called morula. But it is not larger than a zygote.

ii. The morula continues to divide and transforms into blastocyst as it moves further into the uterus.

iii. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and the inner group of cells attached to trophoblast called the inner cell mass.

iv. The trophoblast layer then gets attached to the endometrium and the inner cell mass differentiates into the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst.

As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

32. Restriction Enzymes and DNA: Restriction enzymes are those enzymes which cleave/cut the DNA at the particular sequence of the bases. More than 900 restriction enzymes have been isolated from over 230 strains of bacteria, each of which recognizes different recognition sequences. Restriction enzymes belong to a larger class of enzymes called nucleases. They may be

- i. Exonucleases-remove nucleotides from the ends of DNA
- ii. Endonucleases - make cuts at specific positions within the DNA. Each restriction endonuclease recognizes specific palindromic nucleotide sequences in the DNA. It functions by inspecting the length of DNA sequence, identify specific recognition sequence, bind to DNA and cut the two strands at specific points in the sugar- phosphate backbones.

OR

Selection of recombinants due to inactivation of antibiotics is a laborious process as it requires:

- i. a vector with two antibiotic resistance markers.
- ii. preparation of two kinds of media plates with one antibiotic each.

Transformed cells are first plated on that antibiotic plate which has not been insertional inactivated (ampicillin) and incubated overnight for growth of transformants. For the

selection of recombinants, these transformants are Replica plated on a second antibiotic (tetracycline) plate (which got inactivated due to insertion of a gene). Non-recombinants grow on both the plates (one carrying ampicillin and the other carrying tetracycline) while recombinants will grow only on ampicillin plate.

This entire exercise is laborious and takes more time (two overnight incubations) as well. However, if we choose the second option (insertional inactivation of a marker that produces color in the presence of a chromogenic compound, we can distinguish between the recombinants and non substrate recombinants on a single medium plate (containing one antibiotic and the chromogenic compound) after overnight growth.

33. Biofertilizers are the organisms which increase the nutrient availability to the crop plants either directly or through soil enrichment. They play a role in increasing soil fertility and soil productivity. They are of three types-bacteria, cyanobacteria and mycorrhizal fungi. Bacteria and cyanobacteria function as biofertilizers because of their property of nitrogen fixation while mycorrhizal fungi preferentially withdraw minerals from decaying organic matter for the plant with which they are associated. Nitrogen fixation is the process of conversion of molecular or dinitrogen of the air into nitrogenous compounds.

Nitrogen-fixing bacteria and cyano-bacteria may be free-living or form a symbiotic association with the roots, stem & leaves of higher plants. for example, the Azolla- Anabaena association is of great importance to agriculture. Azolla pinnata is a free-floating freshwater fern which multiplies rapidly, doubling every 5-7 days. The fern can co-exist with rice plants because it does not interfere with their growth. In some southeastern countries especially, China and in southern states in India rice fields are regularly provided with Azolla. Anabaena azollae residing in the leaf-cavities of fern fixes nitrogen. A part of fixed nitrogen is excreted in cavities and available to the fern. The decaying fern plants, release the same for utilization of the rice plants. When a field is dried at the time of harvesting the fern functions as green manure, decomposing and enriching the field for the next crop.

OR

Primary treatment of sewage involves the physical removal of large and small particles from sewage through filtration and sedimentation.

The steps involved in this process are:

- i. floating debris is removed by sequential filtration by passing through wire mesh screens.
- ii. After this, the grit (soil and small pebbles) is removed by sedimentation in settling tanks. The sediment is called primary sludge and the supernatant forms the primary effluent.
- iii. The effluent is then taken for the secondary treatment.

The secondary treatment of sewage is also called biological treatment because, in this treatment, sewage is subjected to biodegradation. It means that it involves the participation of microorganisms. The process of secondary treatment involves the following steps:

- i. Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria and fungi filaments).
- ii. These microbes consume a major part of organic matter in the effluent while growing. This reduces the BOD of the effluent.
- iii. When BOD of sewage gets reduced, it is passed into the settling tank. The bacterial flocs settle in the tank and the sediment is called activated sludge. A small amount of activated sludge is pumped back into the aeration tank to serve as inoculum.
- iv. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters, where other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this process, bacteria produce a mixture of gases, such as methane, hydrogen sulphide and carbon dioxide, which form biogas. The effluent from secondary treatment is generally released into natural water bodies. It helps to reduce water pollution and water-borne diseases.

The gases from biogas are used as a source of energy because it is inflammable.