Biology (044)

CBSE Class 12 Board Examination 2027 – Practice Paper No. 2

Practice Question Paper

Time: 3 hours **Max. Marks: 70**

(i) All questions are compulsory.

(ii) The question paper has five sections and 33 questions.

(iii) Section A has 16 questions of 1 mark each; Section B has 5 questions of 2 marks each; Section C has 7 questions of 3 marks each; Section D has 2 case-based questions of 4 marks each; and Section E has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION A Q. Nos. 1 to 12 are multiple choice questions; only one of the choices is correct. Select and write the correct choice as well as the answer. Q. Nos. 13 to 16 consist of two statements – Assertion (A) and Reason (R); answer them by selecting the appropriate option (A), (B), (C) or (D) given with each. (1 mark each) **[16]**

1 In a village pond, the female flowers of a submerged plant reach the surface of the water on long stalks. The male flowers or pollen grains are released on to the water surface and are carried passively by water currents, and some of them reach the stigmas. Identify the plant and the type of pollination.

(A) Water lily; pollination by insects

(B) Water hyacinth; pollination by water

(C) *Vallisneria*; pollination by water

(D) *Vallisneria*; pollination by wind

2 A nurse explains to a new mother how milk reaches the nipple during breastfeeding. Select the correct sequence of structures through which milk passes after it is secreted.

(A) Mammary alveoli → mammary duct → mammary tubules → lactiferous duct → mammary ampulla

(B) Mammary alveoli → mammary tubules → mammary duct → mammary ampulla → lactiferous duct

(C) Mammary tubules → mammary alveoli → mammary ampulla → mammary duct → lactiferous duct

(D) Mammary alveoli → mammary ampulla → mammary tubules → mammary duct → lactiferous duct

3 A woman consults a doctor the morning after an unprotected intercourse because she does not want to become pregnant. Which of the following is an effective emergency contraceptive measure for her?

(A) Vasectomy of her partner within 72 hours

(B) Medical termination of pregnancy within the first 72 hours

(C) Lactational amenorrhoea for the next six months

(D) Progestogens or progestogen–estrogen combinations, or an IUD, within 72 hours of coitus

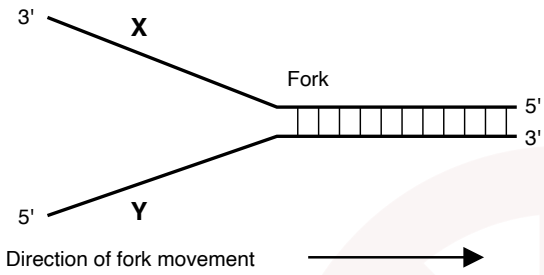
4 A drone (male honey bee) has 16 chromosomes in each of its body cells. How many chromosomes will be present in (i) a body cell of a worker bee of the same species and (ii) a sperm produced by the drone?

(A) 32 and 8
(B) 16 and 8
(C) 32 and 16
(D) 16 and 16

5 Which one of the following is a correct finding of the Human Genome Project?

(A) Less than 2 per cent of the human genome codes for proteins.
(B) The human genome contains about 80,000 to 1,40,000 genes.
(C) The Y chromosome has the largest number of genes.
(D) About 99.9 per cent of the nucleotide bases differ from person to person.

6 The figure given below shows a replication fork in a DNA molecule; X and Y are the two parental template strands. On which template strand will the new DNA be synthesised discontinuously, and which enzyme will join the short fragments so formed?



(A) X; DNA ligase
(B) Y; DNA ligase
(C) X; DNA polymerase
(D) Y; RNA polymerase

For visually impaired candidates (in lieu of the above):
During DNA replication, on which template strand is the new strand synthesised discontinuously, and which enzyme joins the fragments?
(A) The template with polarity 3'→5'; DNA ligase
(B) The template with polarity 5'→3'; DNA ligase
(C) The template with polarity 5'→3'; DNA polymerase
(D) The template with polarity 3'→5'; RNA polymerase

7 In a laboratory experiment, an electric discharge was passed through a closed flask containing CH_4, H_2, NH_3 and water vapour at 800 °C. After some time, amino acids were found in the flask. This experiment supports the idea that

(A) life arose spontaneously from decaying and rotting matter.
(B) the first living units came to the earth from outer space as spores.
(C) new species arise by natural selection of favourable variations.
(D) the first organic molecules could have formed from inorganic constituents under the conditions of the early earth.

8 A patient complains of constipation, abdominal pain and cramps; his stools contain excess mucus and blood clots. Several houseflies were seen around the uncovered food at his home. Identify the causative organism and the role of the houseflies.

(A) *Entamoeba histolytica*; houseflies act as mechanical carriers of the parasite
(B) *Salmonella typhi*; houseflies are the intermediate host
(C) *Entamoeba histolytica*; houseflies inject the parasite when they bite
(D) *Ascaris*; houseflies carry the larvae in their salivary glands

9 Along with chemotherapy, a cancer patient is given α-interferon. What is the role of α-interferon in this treatment?

(A) It kills the rapidly dividing cancer cells by damaging their DNA.

(B) It is an antibody that binds to the tumour and blocks its blood supply.

(C) It is a biological response modifier that activates the patient's immune system to help destroy the tumour.

(D) It suppresses the immune system so that the side-effects of chemotherapy are reduced.

10 A scientist removes the 'ori' sequence from a plasmid cloning vector, then ligates a foreign gene into it and introduces it into *E. coli* cells. What is the most likely result?

(A) The plasmid carrying the foreign gene will not be able to replicate within the host cells.

(B) The host cells will lose resistance to all antibiotics.

(C) The vector can no longer be cut by any restriction enzyme.

(D) The foreign gene will be present in a very high copy number.

11 A child with adenosine deaminase (ADA) deficiency is treated by gene therapy: lymphocytes from his blood are grown in culture, a functional ADA cDNA is introduced into them using a retroviral vector, and they are returned to his body. Why does the child need such infusions periodically?

(A) The retroviral vector destroys the ADA gene after some time.

(B) The ADA enzyme made by the lymphocytes is digested in the stomach.

(C) The child's immune system rejects his own lymphocytes.

(D) The genetically engineered lymphocytes are not immortal.

12 In a park in Pune, a pair of house crows was seen feeding a chick that later grew into an Asian koel. The koel had laid its egg in the crows' nest and left the crows to incubate it. Which option correctly names this interaction and explains why the crows did not throw the koel's egg out of the nest?

(A) Commensalism; the koel benefits, while the crows are neither harmed nor benefited.

(B) Brood parasitism; the koel's egg resembles the crows' eggs in size and colour, which reduces the chance of the crows detecting and ejecting it.

(C) Mutualism; both the koel and the crows benefit from sharing the same nest.

(D) Brood parasitism; the koel's egg is much larger than the crows' eggs, so the crows prefer to incubate it.

13 **Assertion (A):** 'Saheli', the oral contraceptive for females, is a 'once a week' pill.
Reason (R): 'Saheli' contains a steroidal preparation of progestogen and estrogen.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

14 **Assertion (A):** Thalassemia is a quantitative problem of haemoglobin, whereas sickle-cell anaemia is a qualitative problem.
Reason (R): In thalassemia too few globin molecules are synthesised, whereas in sickle-cell anaemia an incorrectly functioning globin is synthesised.

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

15 **Assertion (A):** Cyanobacteria are used as an important biofertiliser mainly in the wheat fields of north India.
Reason (R): Cyanobacteria are autotrophic microbes, many of which can fix atmospheric nitrogen.

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

16 **Assertion (A):** Earthworms are detritivores that break down detritus into smaller particles.
Reason (R): Humus is highly resistant to microbial action and decomposes at an extremely slow rate.

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

SECTION B Q. Nos. 17 to 21 are short answer questions carrying 2 marks each. **[10]**

17 Attempt either option A or B.

A. A plant breeder crossed a pure-breeding pea plant with round seeds (BB) with one having wrinkled seeds (bb). All the F_1 seeds were round, but under the microscope their starch grains were of intermediate size between those of the two parents. (i) Explain how the same pair of alleles shows dominance for one phenotype and incomplete dominance for another. (ii) In the F_2 generation, what will be the ratio of seeds with large, intermediate and small starch grains, and the ratio of round to wrinkled seeds?

OR

B. The karyotype of a 16-year-old girl shows 45 chromosomes, with only one X chromosome. (i) Name the disorder and explain how such a change in chromosome number arises. (ii) State two features of this disorder.

18 The approximate brain capacities of three fossil hominids P, Q and R are given below.

Fossil	Brain capacity (cc)
P	about 650 to 800
Q	about 900
R	about 1400

(i) Identify P, Q and R.
(ii) Which of them probably did not eat meat, and which used hides to protect the body and buried their dead?

19 While working on *Staphylococci* bacteria, a scientist noticed a mould growing in one of his unwashed culture plates; the bacteria could not grow around the mould.
(i) Name the scientist, the mould and the chemical responsible. Who later established the full potential of this chemical as an effective antibiotic?
(ii) Why is the excessive and indiscriminate use of antibiotics harmful in the long run?

20 Attempt either option A or B.

A. A pharmaceutical company plans to use transgenic mice instead of ordinary mice to test whether a new chemical is toxic. (i) How are the transgenic mice made suitable for such testing, and what is the advantage? (ii) Name a human protein produced by transgenic animals that is used to treat emphysema.

OR

B. A scientist wants to introduce a recombinant DNA (i) into the nucleus of an animal cell and (ii) into cells of a plant. Name the method suitable for each case and explain briefly how it works.

21 Attempt either option A or B.

A. Ecologists surveyed frog species in two forest patches of the Western Ghats. Patch M, of area 5 km^2, had 45 frog species; patch N has an area of 160 km^2. (i) Name the relationship between species richness and area described by Alexander von Humboldt and write its equation on a logarithmic scale. (ii) Taking the slope of the regression line (Z) as 0.2 and the same value of C for both patches, calculate the expected number of frog species in patch N.

OR

B. (i) Explain the 'rivet popper hypothesis' given by Paul Ehrlich. (ii) What do the 'rivets on the wings' represent, and why is their loss more serious?

SECTION C Q. Nos. 22 to 28 are short answer questions carrying 3 marks each. **[21]**

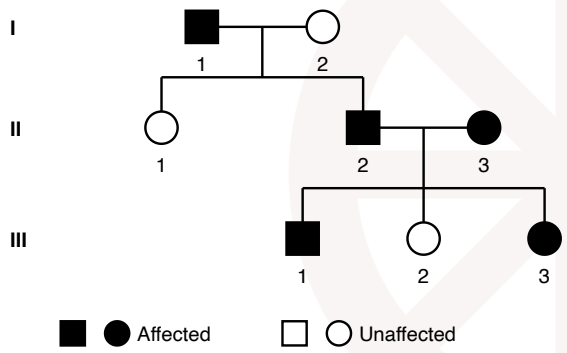
22 A couple who have been trying to have a baby are told by their doctor that the woman ovulates normally and the man's semen has healthy sperms, yet fertilisation does not happen in every cycle.

(a) Where in the female reproductive tract does fertilisation normally take place? Why do not all copulations lead to fertilisation?

(b) Several sperms reach the ovum, but only one fertilises it. How does a sperm enter the ovum, and what prevents the entry of additional sperms?

(c) Which event in the ovum is completed after the entry of the sperm? Name its products.

23 The pedigree given below shows the inheritance of a trait controlled by a single gene in a family.



(a) Is the trait dominant or recessive? Justify using individuals II-2, II-3 and III-2.

(b) Is the gene autosomal or X-linked? Justify.

(c) Write the genotypes of I-2, II-2 and III-2 (use A/a), and find the probability that the next child of II-2 and II-3 will be unaffected.

For visually impaired candidates (in lieu of the above):

A man (I-1) showing a certain trait married a woman (I-2) who did not show it. They had an unaffected daughter (II-1) and an affected son (II-2). The son (II-2) married an affected woman (II-3); their children are an affected son (III-1), an unaffected daughter (III-2) and an affected daughter (III-3). Answer (a), (b) and (c) given above.

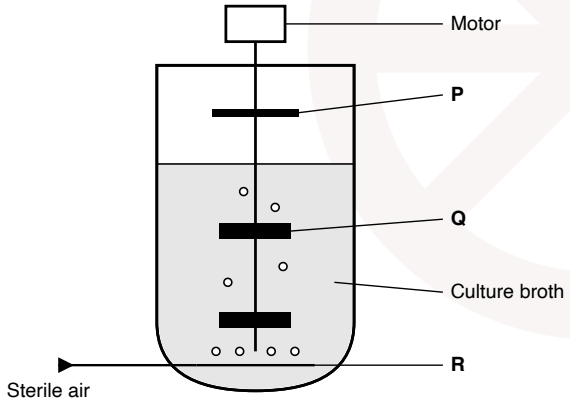
24 In an experiment like that of Hershey and Chase, one batch of bacteriophages had its protein coat labelled with radioactive sulphur (^{35}S) and another batch had its DNA labelled with radioactive phosphorus (^{32}P). Each batch was allowed to infect *E. coli*; the mixture was then agitated in a blender and centrifuged. The hypothetical distribution of radioactivity is given below.

Phage batch	Radioactivity in supernatant (%)	Radioactivity in pellet (%)
I – protein labelled with ^{35}S	85	15
II – DNA labelled with ^{32}P	30	70

(a) Which fraction contains the bacterial cells and which contains the viral coats? What do the data show about the molecule that entered the bacteria?
(b) Why was the mixture agitated in a blender before centrifugation?
(c) What result would have been expected if protein were the genetic material? State the conclusion of the experiment.

25 Arjun, aged 45, has kidney failure. His sister agrees to donate one kidney, but only after tissue matching and blood-group matching have been done. Even after a successful transplant, Arjun will have to take immunosuppressant drugs all his life.
(a) Why cannot a kidney be taken from just any person?
(b) Which type of immune response is responsible for graft rejection, and which lymphocytes mediate it? Why must Arjun take immunosuppressants?
(c) Which lymphocytes produce antibodies, and why is the antibody-mediated response called the humoral immune response?

26 The figure given below shows a sparged stirred-tank bioreactor used by a company to produce a recombinant protein on a large scale.



(a) Identify the parts labelled P, Q and R and give the function of each.
(b) Instead of a single batch, the company plans to multiply the cells in a continuous culture system. How is this done, and why does it give a higher yield of the protein?
(c) Why can the protein collected from the bioreactor not be marketed directly? Name the two processes collectively called downstream processing.
For visually impaired candidates (in lieu of the above):
(a) A sparged stirred-tank bioreactor has three systems: one placed above the culture to control foaming, one that stirs the culture, and one at the base through which air enters. Name each part and give its function.
Answer (b) and (c) given above.

27 During a field visit near Satara, students made the following observations and later read about one more case:

P: Cattle and goats graze in an abandoned field but never browse on the *Calotropis* plants growing there.

Q: Birds avoid eating the brightly coloured Monarch butterflies.

R: The prickly pear cactus, introduced into Australia in the early 1920s, spread rapidly into millions of hectares of rangeland.

(a) Explain P.

(b) How does the Monarch butterfly become distasteful to birds in Q?

(c) Why did the cactus in R spread so rapidly, and how was it finally brought under control?

28 A student studying a village pond and the forest next to it noted the following:

(i) Dead leaves on the forest floor → earthworms → birds

(ii) Phytoplankton → zooplankton → small fish → kingfisher

(iii) Sparrows eat seeds and fruits, and also insects and worms.

(a) Classify food chains (i) and (ii) as grazing or detritus food chains. Through which type does most of the energy flow in the pond and in the forest?

(b) At which trophic levels does the sparrow function? What does this show about the meaning of a trophic level?

(c) What is meant by the standing crop of a trophic level, and how is it measured?

SECTION D Q. Nos. 29 and 30 are case-based questions carrying 4 marks each. **[8]**

29 Read the passage and answer the questions that follow.

Sunita, aged 26, missed her menstrual period and a home pregnancy test kit gave a positive result. The kit detects a hormone in the urine that is produced by the developing placenta. At the antenatal clinic, the doctor explained how the placenta connects the mother and the foetus, how labour begins when the baby is ready to be born, and why the baby should be breastfed from the very first day.

A. Name the hormone detected by the kit and one other hormone that is produced in women only during pregnancy. (1)

B. How is the placenta formed? State two of its functions. (2)

Attempt either subpart C or D.

C. What is the foetal ejection reflex? How does it lead to parturition? (1)

OR

D. What is the milk produced by the mother during the initial few days of lactation called? Why is it important for the new-born baby? (1)

30 Read the passage and answer the questions that follow.

Students of a junior college in Nashik visited a dairy co-operative and a fruit-processing unit. At the dairy, a small amount of curd was added to large vessels of warm milk to make curd. In the canteen, idli batter that had been left overnight had puffed up. At the fruit-processing unit, the bottled grape juice was much clearer than juice made at home; the guide said that enzymes made by microbes are used for this, and that citric acid used as a preservative is also made by a microbe.

A. How does a small amount of curd turn warm milk into curd, and how does this improve the nutritional quality of the milk? (1)

B. Why does idli batter puff up when left overnight? Why is bottled juice clearer than home-made juice? (2)

Attempt either subpart C or D.

C. Name the microbe used for the commercial production of citric acid, and state whether it is a bacterium or a fungus. (1)

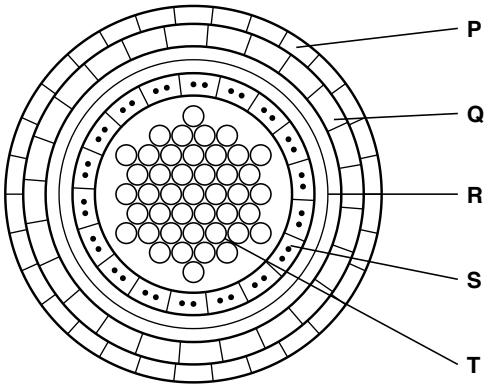
OR

D. Name the organic acids produced by *Acetobacter aceti* and by *Clostridium butylicum*. (1)

SECTION E Q. Nos. 31 to 33 are long answer questions carrying 5 marks each. **[15]**

31 Attempt either option A or B.

A. The figure given below shows the transverse section of one microsporangium of a young anther.



(i) Name the layers labelled P, Q, R and S. State one function common to P, Q and R, and the function of S. (1½)

(ii) Name the tissue labelled T and the process by which its cells form microspore tetrads. If one microsporangium has 64 such cells, each acting as a microspore mother cell, how many pollen grains will be formed, and how many male gametes will these pollen grains finally produce? (1½)

(iii) In over 60 per cent of angiosperms, pollen grains are shed at the 2-celled stage. Name the two cells and state how the male gametes are formed. (1)

(iv) A plant-breeding institute wants to use the pollen of a rare variety in its breeding programme several years later. How can the pollen be kept viable for years, and what is such a store called? (1)

For visually impaired candidates (in lieu of the above):

In lieu of (i) and (ii) above:

(i) Name the four wall layers of a microsporangium from outside to inside. State one function common to the outer three layers, and the function of the innermost layer. (1½)

(ii) Name the tissue present at the centre of a young microsporangium and the process by which its cells form microspore tetrads. If one microsporangium has 64 such cells, each acting as a microspore mother cell, how many pollen grains will be formed, and how many male gametes will these pollen grains finally produce? (1½)

Answer (iii) and (iv) given above.

OR

B. A student soaked bean seeds and castor seeds in water and cut them open. The bean seed had no endosperm left, while the castor seed still had a large endosperm.

(i) Classify the bean and castor seeds on this basis, explain the difference, and give one more example of each type. (1½)

(ii) What happens to the water content and metabolic activity of a seed as it matures? What is the state of inactivity of the embryo called, and why is it important for agriculture? (1)

(iii) A seed of *Lupinus arcticus* excavated from the Arctic Tundra germinated and flowered after an estimated 10,000 years. What does this show about seeds? (1)

(iv) Give three reasons why seeds offer great advantages to angiosperms. (1½)

32 Attempt either option A or B.

A. In a grassland, a wild plant population of 2500 plants is in Hardy–Weinberg equilibrium for a gene controlling flower colour. Purple flower colour (allele R) is dominant over white (allele r), and 225 plants have white flowers.

(i) Calculate the frequencies of alleles R and r, and the expected numbers of RR and Rr plants. (2)

(ii) State the Hardy–Weinberg principle and what the terms of $p^2 + 2pq + q^2 = 1$ represent. (1)

(iii) Twenty years later, after a highway was built through the grassland, the frequency of allele r was found to be 0.45. What does this change indicate, and how is the extent of the change judged? If the change occurred because white-flowered plants left more progeny along the roadsides, name the process responsible and the type of its operation (stabilisation, directional change or disruption) that this represents. (2)

OR

B. (i) The DNA of a bacterium contains 5.0×10^6 base pairs. Calculate the length of its DNA in millimetres. (1)

(ii) A short stretch of B-DNA has 40 base pairs. How many turns of the helix does it make, and what is its length in nm? Why is a purine always paired with a pyrimidine in the double helix? (2)

(iii) Explain how the long DNA is organised (a) in a bacterium such as *E. coli* and (b) in the nucleus of a eukaryotic cell. (2)

33 Attempt either option A or B.

A. A linear DNA molecule 6000 bp long has two recognition sites for the restriction enzyme EcoRI, at 1500 bp and 4200 bp from its left end.

(i) Write the recognition sequence of EcoRI on both strands, showing where it cuts, and explain why the ends produced are called 'sticky ends'. (1½)

(ii) How many fragments will be formed when this DNA is completely digested with EcoRI? Give their sizes, and arrange them in the order of the distance they will move from the well in agarose gel electrophoresis, starting with the one that moves farthest. (1½)

(iii) If the same 6000 bp DNA were a circular plasmid with the same two EcoRI sites, how many fragments would be formed and of what sizes? (1)

(iv) Why must the vector and the source DNA be cut with the same restriction enzyme? Which enzyme joins them? (1)

OR

B. A seed company wants to develop a maize variety resistant to the corn borer, using a gene from the soil bacterium *Bacillus thuringiensis*.

(i) In what form is the Bt toxin present in the bacterium? Explain how the toxin kills an insect larva that eats the leaves of the transgenic plant. (2)

(ii) Which *cry* gene should be introduced into maize for this purpose? Why must the gene be chosen according to the crop and the target pest? (1)

(iii) Name any two groups of insects that are killed by different Bt toxins, with one example each. (1)

(iv) Before such a GM crop can be introduced for public use in India, which organisation must approve it, and what is its role? (1)

All the best for your exam!