Biology (044)

CBSE Class 12 Board Examination 2027 – Practice Paper No. 1

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 The cells in the leaf of a flowering plant contain 18 chromosomes each. How many chromosomes will be present in (i) a synergid of its embryo sac and (ii) a cell of the endosperm of its seed?

(A) 9 and 18 (B) 18 and 27

(C) 9 and 27 (D) 18 and 36

2 An ultrasound scan on day 14 of a regular 28-day menstrual cycle shows that the Graafian follicle of a woman has just ruptured and released the ovum. This rupture was induced by a rapid rise, a little earlier, in the level of

(A) progesterone secreted by the corpus luteum (B) luteinising hormone (LH)

(C) hCG secreted by the placenta (D) relaxin

3 At an IVF clinic, an embryo that had already reached the 16-celled stage in the laboratory was transferred into the mother's body to complete its development. Identify the technique and the site of transfer.

(A) ZIFT – fallopian tube (B) GIFT – fallopian tube

(C) IUI – uterus (D) IUT – uterus

4 A man with blood group AB marries a woman with blood group O. Which blood groups are possible among their children?

(A) A and B only (B) AB and O only

(C) A, B and AB only (D) A, B, AB and O

5 A double-stranded DNA segment is 1500 base pairs long and 30 per cent of its bases are thymine. What is the total number of hydrogen bonds holding its two strands together?

(A) 3000 (B) 3600

(C) 3900 (D) 4500

6 In a mutant strain of *E. coli*, the repressor protein made by the *i* gene can still bind to the operator but can no longer bind to the inducer. If this strain is grown in a medium containing lactose as the only sugar,

(A) the repressor will be inactivated by lactose and the lac operon will be switched on.

(B) RNA polymerase will bind to the operator and transcribe the *z*, *y* and *a* genes.

(C) the repressor will remain bound to the operator, so the *z*, *y* and *a* genes will not be transcribed.

(D) the operon will be switched on but only the *a* gene will be expressed.

7 In a population that is in Hardy–Weinberg equilibrium for a gene with two alleles, the frequency of homozygous recessive individuals is 0.16. What is the frequency of heterozygous individuals?

(A) 0.16

(B) 0.24

(C) 0.48

(D) 0.36

8 A health worker explains to villagers how malaria spreads. Which of the following statements is correct?

(A) *Plasmodium* enters the human body as sporozoites through the bite of an infected female *Anopheles* mosquito.

(B) *Plasmodium* enters the human body as gametocytes through the bite of an infected female *Anopheles* mosquito.

(C) *Plasmodium* enters the human body as sporozoites through the bite of an infected male *Anopheles* mosquito.

(D) *Plasmodium* enters the human body as merozoites through contaminated drinking water.

9 A farm worker bitten by a cobra is given an injection of anti-venom at the hospital. This injection provides

(A) active immunity, because the body makes antibodies against the venom

(B) passive immunity, because it contains preformed antibodies against the venom

(C) active immunity, because it contains preformed antibodies against the venom

(D) passive immunity, because it stimulates the formation of memory cells

10 Match the microbes in Column I with their products in Column II and select the correct option.

Column I (Microbe)	Column II (Product)
P. *Monascus purpureus*	(i) Cyclosporin A
Q. *Streptococcus*	(ii) Streptokinase
R. *Trichoderma polysporum*	(iii) Statins
S. *Propionibacterium sharmanii*	(iv) Swiss cheese

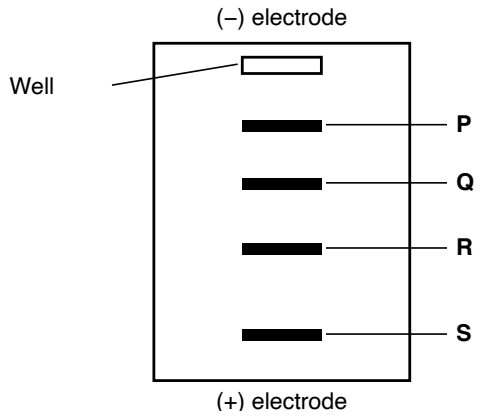
(A) P-(i), Q-(ii), R-(iii), S-(iv)

(B) P-(iii), Q-(i), R-(ii), S-(iv)

(C) P-(ii), Q-(iii), R-(i), S-(iv)

(D) P-(iii), Q-(ii), R-(i), S-(iv)

11 The figure given below shows an agarose gel after electrophoresis of a DNA sample cut with a restriction enzyme. Which band (P, Q, R or S) contains the smallest DNA fragments?



(A) P
(B) Q
(C) R
(D) S

For visually impaired candidates (in lieu of the above):
In agarose gel electrophoresis, DNA fragments move towards the _____ and the smaller fragments move _____.
(A) cathode; farther
(B) anode; farther
(C) anode; a shorter distance
(D) cathode; a shorter distance

12 A wetland near Bhigwan had a population of 500 painted storks at the beginning of a year. During that year, 45 of these storks died. What was the death rate of this population for that year?
(A) 0.09 individuals per stork per year
(B) 0.45 individuals per stork per year
(C) 11.1 individuals per stork per year
(D) 0.9 individuals per stork per year

13 **Assertion (A):** Seeds produced by apomixis in a hybrid variety show segregation of the hybrid characters in the next generation.
Reason (R): In apomixis, an embryo develops in the seed without fertilisation.
(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):** The wings of a butterfly and the wings of a bird are analogous structures.
Reason (R): Analogous structures have the same anatomical structure but perform different functions.
(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):** Bt cotton reduces the need to spray insecticides for controlling cotton bollworms.
Reason (R): Bt cotton carries the genes *cryIAc* and *cryIIAb*, whose protein products are toxic to cotton bollworms.
(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):** The pyramid of energy in an ecosystem is always upright.
Reason (R): In the sea, the pyramid of biomass is generally inverted.

(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. In a botanical garden, pollen grains of a sunflower plant and of a hibiscus plant both land on the stigma of a hibiscus flower. Only the hibiscus pollen grains germinate and produce pollen tubes. (i) What ability of the pistil does this show? (ii) How is the acceptance of one type of pollen and the rejection of the other brought about?

OR

B. Pollen grains recovered from lake sediments thousands of years old can still be identified by palynologists. (i) Name the substance responsible for this and give two of its properties. (ii) At which places on the pollen wall is this substance absent, and why is this important for the pollen grain?

18 The genetic material of a few viruses, such as the tobacco mosaic virus, is RNA, while most organisms use DNA. (i) Give two reasons, based on chemical structure, why DNA is a more stable genetic material than RNA. (ii) State one advantage that an RNA genome gives to such viruses.

19 The table below gives hypothetical antibody levels (arbitrary units) in the blood of a child after the first dose of a vaccine and after a booster dose of the same vaccine given some weeks later.

Days after the injection	**0**	**7**	**14**	**21**	**28**
After first dose	0	2	10	6	3
After booster dose	3	40	120	110	90

(i) Compare the two responses and name each. (ii) Explain why the response to the booster dose is different.

20 Attempt either option A or B.

A. A crop-research laboratory wants to protect a vegetable crop from the root-knot nematode *Meloidogyne incognita*, using the strategy already used successfully in tobacco. (i) Name the strategy. (ii) Explain how it makes the transgenic plant resistant to the nematode.

OR

B. A doctor suspects HIV infection in a patient at a stage when the symptoms have not yet appeared. (i) Why are conventional methods such as serum and urine analysis not useful at this stage? (ii) Name two techniques used for early diagnosis and state the principle of any one of them.

21 Attempt either option A or B.

A. Hypothetical results of collecting peppered moths from tree trunks in two areas of England in the year 1920 are given below.

Area	White-winged moths (%)	Dark-winged moths (%)
X – rural, unpolluted woodland	85	15
Y – woodland near factories	15	85

(i) Explain why dark-winged moths outnumber white-winged moths in area Y. (ii) Why would lichens be almost absent from tree trunks in area Y?

OR

B. A storm carried a few seeds of a wild plant species to an isolated island, where they grew into a new population. After many generations, the frequency of one allele in the island population was found to be very different from that in the original mainland population. (i) Name this effect and explain how it arises. (ii) Name any two other factors that disturb Hardy–Weinberg equilibrium.

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

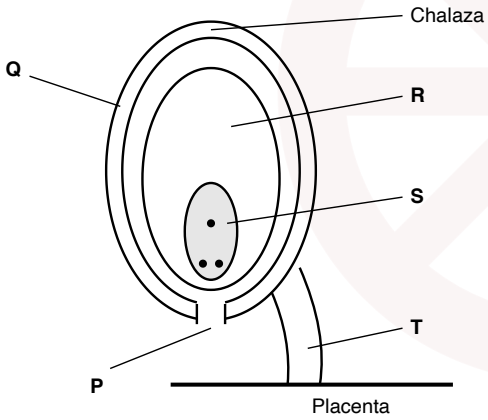
22 (a) How many sperms will be formed from 30 primary spermatocytes, and how many ova from 30 primary oocytes? Give the reason for the difference.

(b) In a man, the Leydig cells are not functional. How would spermatogenesis be affected? Which cells of the testis, acted upon by FSH, help in spermiogenesis?

23 Study the diagram of an anatropous ovule given below.

(a) Name the parts labelled P, R, S and T.

(b) After fertilisation, what do the structure Q and the whole ovule develop into?



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

(a) Name the following parts of an anatropous ovule: (i) the opening through which the pollen tube usually enters; (ii) the mass of cells enclosed within the integuments; (iii) the female gametophyte located in the nucellus; (iv) the stalk that attaches the ovule to the placenta.

(b) After fertilisation, what do the integuments and the whole ovule develop into?

24 Seema has normal colour vision, but her father was colour blind. She marries Ramesh, who has normal colour vision.

(a) Write the genotypes of Seema and Ramesh and work out the cross to show the genotypes of their children.

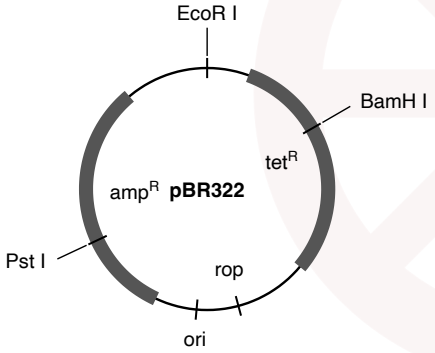
(b) What percentage of their sons and of their daughters are expected to be colour blind?

(c) Why is colour blindness much more common in men than in women?

25 A part of the template strand of a transcription unit in a eukaryote is: 3'–TACCGTAAGCTT–5'
(a) Write the sequence of the mRNA transcribed from it and of the coding strand, showing polarity.
(b) When the mature mRNA of this gene was isolated from the cytoplasm, three differences from the gene were noticed: (i) some internal stretches present in the gene were missing in the mRNA; (ii) an unusual nucleotide was present at its 5'-end; (iii) it ended in a long stretch of adenylate residues that is not coded by the gene. Name and explain the process responsible for each observation.

26 Three patients from a village visit a primary health centre.
Patient P: sustained high fever (39 °C to 40 °C), weakness, stomach pain, constipation and loss of appetite; the Widal test is positive.
Patient Q: internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage; eggs of a roundworm are seen in the stool.
Patient R: dry, scaly, intensely itching lesions in the skin folds of the groin and between the toes.
For each patient, name the disease and its causative organism, and state how the infection is acquired.

27 The figure shows the *E. coli* cloning vector pBR322. A scientist ligates a foreign gene into the Pst I site of this vector and uses the ligation mixture to transform *E. coli* cells.
(a) Which antibiotic resistance will the recombinant plasmids lose, and which will they keep? Why?
(b) Explain how the scientist can separate recombinants from non-recombinants using ampicillin and tetracycline.
(c) Why is this method of selection considered cumbersome? Name the alternative selectable marker based on colour production.



28 A herd of spotted deer was introduced into a forest reserve where the carrying capacity (K) for this species is 800 deer. The intrinsic rate of natural increase (r) is 0.3 per year.
(a) Write the Verhulst–Pearl logistic growth equation.
(b) Calculate the rate of population growth (dN/dt) when the population (N) is 400 and when it is 600. At which of these two sizes is the population growing faster?
(c) What will be the growth rate when N reaches 800? Why is the logistic model considered more realistic than the exponential model?

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.

An ASHA worker conducts an awareness session for women and couples at a primary health centre in a village. Rekha, whose first child is one year old, wants to space her next pregnancy by about three years with an effective, reversible method that she need not remember every day. A couple, Mohan and his wife Kavita, have completed their family and want to know about permanent methods of birth control. The worker also explains that sexually transmitted infections (STIs) should be detected early, and that in India pregnancy can be medically terminated only under conditions laid down by law.

A. Suggest a suitable method for Rekha and state how it prevents conception. (1)

B. Name the permanent method available to Mohan and to Kavita, and briefly describe what is done in each. (2)

Attempt either subpart C or D.

C. According to the MTP (Amendment) Act, 2017, who must give the opinion for terminating a pregnancy (i) within the first 12 weeks and (ii) after 12 weeks but before 24 weeks? (1)

OR

D. Name any two STIs that are completely curable if detected early and treated properly. (1)

30 Read the passage and answer the questions that follow.

A sewage treatment plant of a city treats the waste water of a large residential area. A student recorded the following hypothetical BOD values of water samples taken at different stages of the plant.

Sample	BOD (mg/L)
Raw sewage entering the plant	350
After primary treatment	230
Effluent after secondary treatment, from the settling tank	20

The student also noticed that a part of the sludge from the settling tank was pumped back into the aeration tank, and the rest was sent to large closed tanks that produced a gas used to run the plant's generator.

A. Calculate the percentage reduction in BOD brought about by secondary treatment, and name the organisms responsible for it. (1)

B. What are 'flocs'? Explain why a part of the activated sludge is returned to the aeration tank and what happens to the remaining sludge. (2)

Attempt either subpart C or D.

C. What does BOD measure, and what does a high BOD of the raw sewage indicate? (1)

OR

D. Name the group of bacteria that produce methane in the closed tanks, give one example, and name one other natural habitat where they are found. (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. (i) A pea plant producing round, yellow seeds was crossed with a plant producing wrinkled, green seeds. The progeny had round yellow, round green, wrinkled yellow and wrinkled green seeds in the ratio 1 : 1 : 1 : 1. Name this type of cross, give the genotype of the round, yellow-seeded parent and show the cross with gametes. (2)

(ii) In *Drosophila*, a female heterozygous for two genes, which received the dominant alleles A and B from one parent and the recessive alleles a and b from the other, was crossed with an aabb male. The progeny obtained were:

Phenotype of progeny	Number
Dominant for both genes (A, B)	418
Recessive for both genes (a, b)	402
Dominant A, recessive b	92
Recessive a, dominant B	88

Calculate the recombination frequency between the two genes. Why does this result differ from the 1 : 1 : 1 : 1 ratio in (i)? How is the recombination frequency used by geneticists? (3)

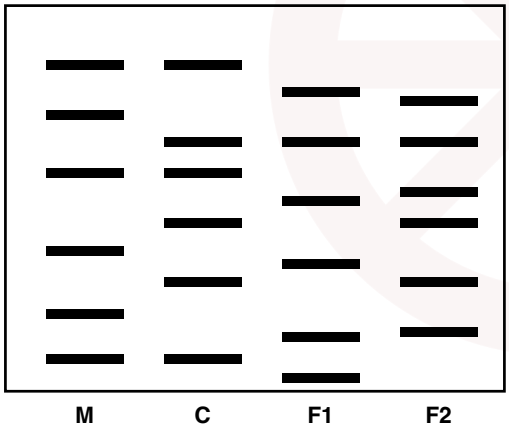
OR

B. In a disputed parentage case, DNA fingerprints of the mother (M), the child (C) and two men (F1 and F2) were prepared. The bands obtained are shown in the figure given below.

(i) What is the basis of DNA fingerprinting? Name the type of DNA sequence used as a probe. (1)

(ii) List the steps of the DNA fingerprinting technique (Southern blot hybridisation). (2)

(iii) Which man is the biological father of the child? Justify your answer using the bands. (2)



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

In place of (iii): The child's DNA fingerprint has six bands. Three of them match bands of the mother. The other three bands are all present in the fingerprint of man F2, while only one of them is present in that of man F1. Which man is the biological father? Justify. (2)

32 Attempt either option A or B.

A. A biotechnology laboratory has to amplify a gene of interest and then introduce it into *E. coli*.

(i) Name the three steps of each cycle of the polymerase chain reaction (PCR). Why is the DNA polymerase used in PCR isolated from *Thermus aquaticus*? (2)

(ii) If the reaction starts with 5 copies of the target DNA, how many copies will be present after 10 cycles (assuming every cycle doubles the DNA)? (1)

(iii) *E. coli* cells cannot normally take up DNA. Explain how they are made competent and how recombinant DNA is then forced into them. (2)

OR

B. (i) Describe the structure of human insulin and how its pro-hormone is processed in the body. (1½)

(ii) Explain how Eli Lilly produced human insulin using recombinant DNA technology in 1983. (1½)

(iii) Why was insulin from the pancreas of slaughtered cattle and pigs not ideal for diabetic patients? (1)

(iv) What is biopiracy? Give one example related to India. (1)

33 Attempt either option A or B.

A. A group of college students in Pune visited (P) a *devrai* (sacred grove) in the Western Ghats region of Maharashtra, (Q) a zoological park and (R) a facility storing seeds of different strains of crop plants.

(i) Classify P, Q and R as *in situ* or *ex situ* conservation and justify your classification. (1½)

(ii) Give one advantage of protecting species in P over keeping them in Q, and one situation in which conservation in Q or R becomes necessary. (1)

(iii) What is a biodiversity hotspot? Name the hotspot to which the Western Ghats belong and the other two hotspots that cover India's exceptionally rich biodiversity regions. (1½)

(iv) Name the technique by which gametes of threatened species can be preserved in a viable and fertile condition for long periods. (1)

OR

B. In a grassland ecosystem, the producers fix 30,000 kJ m^{-2} yr^{-1} of energy as gross primary productivity (GPP), and 40 per cent of the GPP is used up in their respiration.

(i) Calculate the net primary productivity (NPP). (1)

(ii) Assuming the 10 per cent law applies from the NPP of producers upward, calculate the energy available at the level of secondary carnivores in the food chain: grass → grasshopper → frog → snake. (1)

(iii) Draw a labelled pyramid of energy for this food chain showing the values. (1)

(iv) State any two limitations of ecological pyramids. (2)

All the best for your exam!