Biology

HSC Board Exam February–March 2027 – Practice Paper No. 2

Practice Question Paper

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

(1) The question paper is divided into four sections.
(2) Section A: Q. No. 1 contains ten multiple choice type questions carrying one mark each. Q. No. 2 contains eight very short answer type questions carrying one mark each.
(3) Section B: Q. No. 3 to Q. No. 14 are twelve short answer-I type questions carrying two marks each. (Attempt any eight)
(4) Section C: Q. No. 15 to Q. No. 26 are twelve short answer-II type questions carrying three marks each. (Attempt any eight)
(5) Section D: Q. No. 27 to Q. No. 31 are five long answer type questions carrying four marks each. (Attempt any three)
(6) Figures to the right indicate full marks.
(7) Draw neat and well-labelled diagrams wherever necessary.
(8) For each MCQ, the correct answer must be written along with its alphabet, e.g. (a) ..... / (b) ..... . Evaluation will be done for the first attempt only.
(9) Start answers to each section on a new page.

SECTION A – Q.1 Select and write the correct answer for the following multiple choice type of questions. **[10]**

(i) The outer wall (exine) of a pollen grain, which is resistant to chemicals and helps pollen grains to remain preserved as fossils, is made up of _____.

(a) cellulose (b) pectin
(c) sporopollenin (d) lignin

(ii) In the seminiferous tubules of the human testis, nutrition to the developing sperms is provided by the _____.

(a) Leydig (interstitial) cells (b) Sertoli (sustentacular) cells
(c) spermatogonia (d) spermatids

(iii) Two persons, each a carrier of sickle-cell anaemia (Hb^AHb^S), marry. Among their children who survive, the ratio of carriers to normal children is expected to be _____.

(a) 1 : 2 : 1 (b) 3 : 1
(c) 2 : 1 (d) 1 : 1

(iv) In eukaryotes, the messenger RNA (primary transcript / hnRNA) is transcribed by _____.

(a) RNA polymerase I (b) RNA polymerase II
(c) RNA polymerase III (d) DNA polymerase

(v) Early in the morning, drops of water are seen along the leaf margins of grasses. This loss of water in liquid form takes place through _____.

(a) stomata (b) lenticels
(c) hydathodes (d) cuticle

(vi) 'Brown heart' disease in plants is a deficiency symptom of _____.

(a) boron (b) copper
(c) zinc (d) manganese

(vii) The vital capacity of human lungs is the sum of _____.

(a) tidal volume and inspiratory reserve volume

(b) tidal volume, inspiratory reserve volume and expiratory reserve volume

(c) tidal volume, expiratory reserve volume and residual volume

(d) inspiratory reserve volume, expiratory reserve volume and residual volume

(viii) A patient loses weight and feels weak; his blood shows low sugar, low Na^+ and high K^+, and much Na^+ and water are lost in the urine. This disorder is caused by _____.

(a) hypersecretion of glucocorticoids

(b) hyposecretion of mineralocorticoids and glucocorticoids

(c) hyposecretion of insulin

(d) hypersecretion of thyroxine

(ix) In a polymerase chain reaction (PCR), starting from one molecule of the target DNA, the number of copies obtained at the end of 6 cycles is _____.

(a) 12

(b) 36

(c) 64

(d) 128

(x) On a forest floor, partly decomposed organic matter builds up as a dark, structureless, colloidal material that microbes break down only very slowly. The step of decomposition that produces this material is _____.

(a) fragmentation

(b) leaching

(c) humification

(d) mineralisation

SECTION A – Q.2 Answer the following questions. **[8]**

(i) Name the condition in which flowers are self-pollinated even before they open, as in the underground flowers of *Commelina benghalensis*.

(ii) Two populations of frogs live in the same pond but do not interbreed, because one population breeds in June and the other in September. Name this isolating mechanism.

(iii) Name the compound most widely used as a source of ethylene for ripening fruits.

(iv) Name the largest commissure (band of nerve fibres) that connects the two cerebral hemispheres.

(v) Name the enzyme present in HIV that enables the virus to make DNA from its RNA.

(vi) Name the new breed of sheep developed in Punjab by crossing Bikaneri ewes with Marino rams.

(vii) State Gause's competitive exclusion principle.

(viii) Why should motor vehicles fitted with a catalytic converter use only unleaded petrol?

SECTION B Attempt any EIGHT of the following questions. (2 marks each) **[16]**

Q.3 A student wants to watch pollen tubes growing from pollen grains placed on a glass slide in a synthetic medium. (a) Name two substances she should add to the medium and state the role of each. (b) From which part of the pollen wall will the pollen tube emerge, and why from there?

Q.4 Suggest a suitable assisted reproductive technique for each couple and explain it briefly. (a) Couple X: the husband is unable to inseminate the wife because of a very low sperm count. (b) Couple Y: the husband's semen is normal and the wife's ovaries release healthy eggs, but both her oviducts are obstructed along their length, so the sperms can never reach the egg inside her body.

Q.5 In the Hershey–Chase experiment, bacteriophages grown on a medium containing radioactive sulphur (^{35}S) were allowed to infect *E. coli*. After blending and centrifugation, where was the radioactivity found – inside the bacteria or in the supernatant? What does this result show? Why was ^{35}S chosen to label these phages?

Q.6 A student claims that the strong muscles a wrestler builds by exercise will be inherited by his son. (a) Which theory of evolution supports this claim? (b) Describe the experiment that disproved this theory and state the conclusion drawn from it.

Q.7 A gardener regularly cuts off the shoot tips of the plants in a hedge. After a few weeks the hedge becomes dense and bushy. Name the phenomenon involved and explain it, naming the plant hormones concerned.

Q.8 During vigorous exercise, the working muscles take more oxygen from the blood than they do at rest. Explain this with the help of the oxygen–haemoglobin dissociation curve and name the effect involved.

Q.9 In a dark cinema hall you can make out the shapes of people but not the colours of their clothes. Explain this on the basis of the two types of photoreceptor cells of the retina.

Q.10 A lymphocyte binds to a virus-infected body cell and secretes a substance that makes a hole in the infected cell, killing it. (a) Name this lymphocyte and the substance it secretes. (b) Name any two other types of T-lymphocytes formed in the same clone and state the function of each.

Q.11 A dairy farmer mates closely related cows and bulls of his herd for five generations to obtain pure lines. (a) Name this type of breeding and give one advantage of it. (b) After some generations the fertility and milk yield of the herd fall. What is this problem called and how can it be overcome?

Q.12 A mixture of three DNA fragments of 300 bp, 1200 bp and 4000 bp is loaded into a well of an agarose gel and an electric field is applied. (a) Towards which electrode will the fragments move, and why? (b) Which fragment will be found farthest from the well and which nearest to it? Give a reason.

Q.13 A herd of spotted deer in a sanctuary had 500 animals at the beginning of a year. During the year 200 fawns were born and 60 deer died; no deer entered or left the sanctuary. (a) Calculate the birth rate and the death rate of the herd per 1000 individuals per year. (b) What is the size of the herd at the end of the year? (c) Which population characteristic has the greatest influence on population growth?

Q.14 The producers of a grassland fix 24,000 kJ of energy per m^2 per year by photosynthesis, and they use 9,600 kJ m^{-2} $year^{-1}$ of it in respiration. Calculate the net primary productivity (NPP). What percentage of the gross primary productivity is lost in respiration, and why is NPP important for the ecosystem?

SECTION C Attempt any EIGHT of the following questions. (3 marks each) **[24]**

Q.15 The water of a tender coconut is a liquid, while the white kernel lining the shell is solid. (a) Name the type of endosperm development seen in coconut and explain how it takes place. (b) How does cellular endosperm differ from it? Give one example. (c) Describe helobial endosperm with an example.

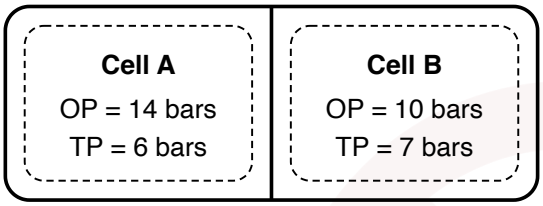
Q.16 Explain the process of oogenesis in the human female. Why is the egg released at ovulation called a secondary oocyte? How many functional ova are formed from 100 primary oocytes, and how many sperms from 100 primary spermatocytes?

Q.17 A woman with normal blood clotting, whose father was haemophilic, marries a haemophilic man. Using a checkerboard, work out the genotypes and phenotypes of their children. What is the chance that (a) a son of this couple is haemophilic, and (b) a child of this couple is a haemophilic daughter?

Q.18 *E. coli* cells grown for many generations in a medium containing ^{15}N were transferred to a medium containing ^{14}N. The bacteria divide once every 20 minutes. Samples were taken at 20, 40 and 60 minutes after transfer and their DNA was separated by density gradient centrifugation. (a) Name the technique and the medium used. (b) What type(s) of DNA band will be seen at 20 minutes and at 40 minutes? (c) What proportion of the DNA molecules will be hybrid at 60 minutes? What does the experiment prove?

Q.19 Identify the mode of speciation in each case and explain it. (a) A river changes its course and divides a population of land snails into two groups that can no longer meet; after many generations they cannot interbreed. (b) Within a single lake, a new species of fish arises without any geographical barrier, because of reproductive isolation. (c) Two different species of plants cross, and doubling of chromosomes in the hybrid gives a new fertile species.

Q.20 The figure shows two adjacent plant cells A and B with their osmotic pressure (OP) and turgor pressure (TP). (a) Calculate the diffusion pressure deficit (DPD) of each cell. (b) In which direction will water move between them? Give a reason. (c) Express the water potential of each cell and state the DPD of cell A when it becomes fully turgid.



Two adjacent parenchyma cells (common wall in the middle)

Q.21 A doctor asks a patient to breathe in deeply and then breathe out. Explain the roles of the diaphragm, the external intercostal muscles and the pressure changes in the thorax during (a) inspiration and (b) expiration.

Q.22 A post-menopausal woman complains of soft, bending bones that fracture easily. Her report shows hypersecretion of a hormone that removes calcium from the bones. (a) Name the hormone, its gland and the condition. How does this hormone raise the blood calcium level? (b) Name the hormone that acts antagonistically to it and give its source. (c) What happens when the first hormone is secreted in too small an amount?

Q.23 An Rh-negative woman married to an Rh-positive man has her first baby, which is Rh-positive and healthy. The doctor warns her about her next pregnancy if the foetus is again Rh-positive. (a) Name the disease that the second baby may suffer from. (b) Explain why the first baby was safe but the second may be affected. (c) How can this be prevented?

Q.24 A start-up plans to grow microorganisms on sugarcane molasses and agricultural waste to produce protein-rich feed for poultry and fish. (a) What is single cell protein (SCP)? (b) Name one alga and one yeast used for producing SCP. (c) Give any two advantages of SCP.

Q.25 Bt cotton is grown by many farmers in Maharashtra. (a) What does 'Bt' stand for, and which gene has been introduced into this plant? (b) Explain how the protein made by Bt cotton kills a susceptible insect that feeds on it. (c) Why are Bt plants preferred to spraying the bacterium on crops?

Q.26 A lake surrounded by farms receives run-off water carrying fertilizers, and sewage from nearby homes. After some years the water turns green and smelly, and fish begin to die. (a) Name this phenomenon and give its two types. (b) Explain the sequence of events that leads to the death of fish. (c) What is BOD and what does a high BOD indicate?

SECTION D Attempt any THREE of the following questions. (4 marks each) **[12]**

Q.27 In maize, the gene for coloured grain (C) is dominant over colourless (c) and full grain (S) is dominant over shrunken (s). A plant heterozygous for both genes (CS/cs, obtained from a cross of coloured full × colourless shrunken) was test-crossed with a colourless shrunken (cs/cs) plant. The offspring were:

Class of offspring	Number
Coloured, full	482
Colourless, shrunken	478
Coloured, shrunken	22
Colourless, full	18
Total	1000

(a) What ratio would be expected if the two genes assorted independently? Do these results agree with it? (b) Name the phenomenon shown and identify the parental and recombinant types. (c) Calculate the percentage of recombination and state whether the genes are strongly or loosely linked. (d) Explain how the recombinant types arise and at which stage of meiosis this happens.

Q.28 Draw a neat labelled diagram of the cloverleaf structure of t-RNA. Explain why t-RNA is described as an adapter molecule. Write the anticodon of the t-RNA that pairs with the codon 5′-UGG-3′. A ribosome has three binding sites for t-RNA – name them and state which site the initiator charged t-RNA occupies.

Q.29 A heart that is transplanted into a patient continues to beat rhythmically even though its nerves have been cut. Draw a neat labelled diagram of the conducting system of the human heart. Trace the path of the cardiac impulse through it. Why is the SA node called the pacemaker, and how do both ventricles come to contract at the same time?

Q.30 A newly dug village pond is left undisturbed for several hundred years and is finally covered by a forest. (a) Name the type of succession. (b) Describe the sequence of stages, naming one plant typical of each stage. (c) Define 'pioneer species' and 'climax community'. (d) Why would a burnt forest return to its climax much faster than this pond?

Q.31 (a) Name the four major causes of loss of biodiversity known as the 'Evil Quartet' and give one example of each. (b) In a coastal creek polluted by an industry, the mercury content measured (hypothetical values) was: water 0.00001 ppm, zooplankton 0.05 ppm, small fish 0.6 ppm, large fish 3 ppm and fish-eating birds 20 ppm. Name this phenomenon and explain why the concentration is highest in the birds. Name one other substance that behaves in the same way.

All the best for your exam!