Science and Technology Part 2

SSC Board Exam March 2027 – Practice Paper No. 2

Model Answer Paper

Time: 2 hours **Max. Marks: 40**

Model answers show one correct method; any other correct method gets full marks.

Q.1 (A) Choose the correct alternative and write its alphabet against the sub-question number. **[5]**

(i) In Paramecium, asexual reproduction takes place by _____.

(A) simple binary fission (B) transverse binary fission
(C) longitudinal binary fission (D) budding

Answer (1 mark)
(B) transverse binary fission
Paramecium divides across its body (transverse plane). Amoeba shows simple binary fission and Euglena shows longitudinal binary fission.

(ii) In which of the following animals is the notochord present throughout the length of the body?

(A) Herdmania (B) Balanoglossus
(C) Amphioxus (D) Rohu

Answer (1 mark)
(C) Amphioxus
Amphioxus belongs to sub-phylum Cephalochordata, in which the notochord extends along the whole body length. (Herdmania: notochord only in the tail of the larva; Balanoglossus: only in the proboscis; Rohu: a vertebrate, in which the notochord is replaced by the vertebral column.)

(iii) In a nuclear power plant, heat energy is obtained by the fission of nuclei of _____.

(A) Hydrogen (B) Uranium-235
(C) Carbon-12 (D) Helium

Answer (1 mark)
(B) Uranium-235
When a neutron strikes a U-235 nucleus, it splits (fission) and releases a large amount of energy; this heat converts water into steam.

(iv) We get _____ of energy from one gram of lipids.

(A) 4 Kcal (B) 9 Kcal
(C) 17 Kcal (D) 38 Kcal

Answer (1 mark)
(B) 9 Kcal
Carbohydrates and proteins give 4 Kcal per gram, while lipids (fats) give 9 Kcal per gram.

(v) Golden rice is a genetically modified variety of rice that contains a higher amount of _____.

(A) vitamin C (B) iron
(C) beta carotene (vitamin A) (D) proteins

Answer (1 mark)
(C) beta carotene (vitamin A)
A gene for synthesis of vitamin A (beta carotene) has been introduced into golden rice; the variety developed in 2005 contains about 23 times more beta carotene than the normal variety.

Q.1 (B) Answer the following questions. **[5]**

(i) Name the fungus used for the commercial production of citric acid from sugar molasses.

Answer (1 mark)
Aspergillus niger.
(Citric acid is used in drinks, toffees and chocolates.)

(ii) Name the ape, found in North India and East Africa, which is the first record of a human-like animal.

Answer (1 mark)
Ramapithecus.

(iii) Find the odd one out: Rohu, Shark, Sea horse, Dolphin

Answer (1 mark)
Dolphin. It is a mammal (class Mammalia: mammary glands, warm-blooded); the others are fishes of class Pisces.

(iv) Complete the correlation: Potato : 'eyes' on the tuber :: Bryophyllum : _____

Answer (1 mark)
Buds on the leaf margin.
(Both are examples of vegetative propagation.)

(v) Who is the chairman of the District Disaster Management Authority?

Answer (1 mark)
The District Collector.

Q.2 (A) Give scientific reasons. (Any two) **[4]**

(i) A power plant based on natural gas causes less pollution than a power plant based on coal.

Answer (2 marks)
Burning of coal releases carbon dioxide, sulphur oxides and nitrogen oxides, along with soot and ash, which pollute the air and harm health.
Natural gas does not contain sulphur, so no sulphur oxides are formed when it burns, and there is no ash.
Also, the efficiency of a natural gas power plant is higher than that of a coal-based plant, so less fuel has to be burnt to produce the same amount of electricity.
Hence a natural gas power plant causes less pollution.

Marking: Natural gas contains no sulphur, so no sulphur oxides (coal gives sulphur oxides, soot and ash) – 1 mark · Higher efficiency, so less fuel burnt for the same electricity / less pollution – 1 mark

Examiner tip: The key words are 'natural gas does not contain sulphur'. Do not write that natural gas is a renewable source; it is a fossil fuel.

(ii) Monozygotic twins are always of the same sex (both boys or both girls).

Answer (2 marks)
Monozygotic twins develop from a single zygote.
Within about 8 days of zygote formation, the cells of the embryo separate into two groups and

each group develops into a separate embryo.
Since both embryos come from the same zygote, they have exactly the same genetic material, including the same sex chromosomes.
Hence monozygotic twins are genetically identical and are always of the same sex.

Marking: Formed from one zygote that splits into two embryos – 1 mark · Same genetic material / same sex chromosomes, hence same sex – 1 mark

Examiner tip: Contrast with dizygotic twins, which come from two eggs fertilised by two sperms and may be of different sex.

(iii) Vaccines produced with the help of biotechnology are safer than traditional vaccines.

Answer (2 marks)
Traditional vaccines were made from completely or partially killed pathogens, so some persons could contract the disease from the vaccine itself.
In biotechnology, the gene for the antigen protein is isolated from the pathogen and the antigen is produced in the laboratory.
Only this pure antigen protein is injected; it keeps the immune system active without introducing the pathogen.
Hence such vaccines are safer. (They are also more thermo-stable and remain active for a longer time, e.g. polio and hepatitis vaccines.)

Marking: Traditional vaccines used killed/weakened pathogens – risk of disease – 1 mark · Biotech vaccines contain only pure antigen protein made from isolated gene – 1 mark

Examiner tip: Mention 'antigen' clearly; just writing 'they are made in a laboratory' is not enough.

Q.2 (B) Answer the following questions. (Any three) **[6]**

(i) A cell of the onion plant has 16 chromosomes (2n = 16).
(a) A cell at the root tip divides by mitosis. How many daughter cells are formed and how many chromosomes does each contain?
(b) A cell in the anther divides by meiosis to form pollen grains. How many daughter cells are formed and how many chromosomes does each contain?

Answer (2 marks)
(a) Mitosis: 2 daughter cells are formed; each has 16 chromosomes (2n), the same as the parent cell.
(b) Meiosis: 4 daughter cells are formed; each has 8 chromosomes (n), i.e. half the number in the parent cell.
(In meiosis one diploid (2n) cell forms four haploid (n) cells.)

Marking: (a) 2 cells ½ + 16 chromosomes each ½ · (b) 4 cells ½ + 8 chromosomes each ½

Examiner tip: Meiosis halves the chromosome number; do not write 16 for the pollen cells.

(ii) A dairy in Kolhapur district makes cheese and labels one of its products 'vegetarian cheese'.
(a) Name any two microbes mixed with milk during cheese production and state why they are added.
(b) Why can cheese made with protease obtained from fungi be called vegetarian cheese?

Answer (2 marks)
(a) Any two: Lactobacillus lactis, Lactobacillus cremoris, Streptococcus thermophilus. They are added (along with colours) to impart sourness to the milk.
(b) To make the curd dense, the enzyme rennet, obtained from the alimentary canal of cattle, was used traditionally. Now protease enzyme obtained from fungi is used instead. As no animal product is used, such cheese is called vegetarian cheese.

Marking: (a) Two microbes ½ (both needed) + purpose (sourness) ½ · (b) Rennet from cattle replaced by fungal protease – 1 mark

Examiner tip: Write the scientific names correctly; 'bacteria' alone does not get the mark.

(iii) Archaeologists excavating an ancient settlement at Inamgaon in Pune district found charred grains and pieces of bones.
(a) Name the method used to find the age of such remains. On what is it based?
(b) Why does the ratio of C-14 to C-12 in these remains keep changing after the death of the organism?

Answer (2 marks)
(a) Carbon dating. It is based on the radioactive decay of naturally occurring carbon-14 (C-14). (The method was developed by Willard Libby.)
(b) A living plant or animal keeps taking in carbon. After death, intake of carbon stops and only the decay of radioactive C-14 continues. C-12 is non-radioactive and does not decay. Hence the ratio of C-14 to C-12 keeps changing; by measuring the activity of C-14 and this ratio, the time since death can be calculated.

Marking: (a) Carbon dating ½ + based on radioactive decay of C-14 ½ · (b) Carbon intake stops; C-14 decays but C-12 does not – 1 mark

Examiner tip: State clearly that C-12 is non-radioactive; that is why the ratio changes.

(iv) Newspapers sometimes report that several people in a village died after drinking illegally made liquor.
(a) Why does such liquor cause deaths?
(b) Write two harmful effects of alcohol on the body or on adolescents.

Answer (2 marks)
(a) Liquor is produced from alcohol obtained by fermentation of substances. If this process is carried out in a wrong way, poisonous chemicals are formed in the liquor, and it proves fatal for many people at a time.
(b) Any two:
1. It reduces the efficiency of the nervous system (especially the brain) and the liver, and reduces the lifespan.
2. In adolescents it hinders brain development, so memory and learning ability become weak.
3. An addicted person cannot think rationally and faces physical, mental, social and family problems.

Marking: (a) Wrong fermentation process forms poisonous chemicals – 1 mark · (b) Two harmful effects – ½ mark each

Examiner tip: In (a) the key idea is that a wrong fermentation process forms poisonous chemicals; 'alcohol is bad for health' alone gets no mark.

(v) Your school is preparing a first aid kit for the Std 10 trek to Rajgad fort.
(a) Write two objectives of first aid.
(b) Name any two items that must be kept in the kit and write the use of each.

Answer (2 marks)
(a) Any two: saving the life of the victim; preventing the condition of the victim from becoming worse; relieving the pain; attempting to improve the condition until medical help is available.
(b) Any two, for example:
1. Antiseptic (Dettol/Savlon) – to clean wounds and prevent infection.
2. Bandage strips / wound gauze – to cover and dress wounds.
3. Medicated cotton – to clean wounds or apply antiseptic.
4. Thermometer – to measure body temperature.

5. Torch – to see in darkness.
6. Scissors / safety pins – to cut and fix bandages.

Marking: (a) Two objectives – ½ mark each · (b) Two items with use – ½ mark each

Examiner tip: In (b) an item without its use gets only part credit; write the use next to each item.

Q.3 Answer the following questions. (Any five) **[15]**

(i) Raju, a farm labourer, has very strong arm muscles because he lifts heavy sacks every day. His friend says, "Raju's children will also be born with strong arm muscles."
(a) Which theory of evolution supports the friend's statement? Name the scientist who proposed it.
(b) Explain this theory with one example from the textbook (other than development of muscles).
(c) Is the friend's statement correct? Why was this theory not accepted?

Answer (3 marks)

(a) Lamarckism, i.e. the theory of inheritance of acquired characters, proposed by Jean-Baptiste Lamarck.
(b) Lamarck said that organs develop due to their use and weaken due to disuse ('use or disuse of organs'), and that such changes acquired during the lifetime are passed on to the next generation. Example (any one): the neck of the giraffe became long because giraffes stretched their necks for several generations to eat leaves of tall trees; wings of ostrich and emu became weak due to disuse; feet of ducks and swans became suitable for swimming; snakes lost their legs due to the burrowing habit.
(c) No. Development of organs by use, or their degeneration by disuse, was accepted, but its transfer from generation to generation was not. It was verified many times that changes brought about in one's own body (acquired characters) are not passed on to the next generation. Hence Lamarck's theory was disproved.

Marking: (a) Lamarckism ½ + Lamarck ½ · (b) Use and disuse + inheritance of acquired characters ½, one textbook example ½ · (c) Not correct; acquired characters are not inherited – 1 mark

Examiner tip: Do not repeat the ironsmith or muscle example in (b); the question asks for a different example.

(ii) A dietician advises a growing teenager to include milk, eggs, pulses and soyabean in her daily diet as sources of proteins.
(a) What are proteins? Why are proteins from milk and eggs called 'first class' proteins?
(b) Name any two proteins produced in our body and the part of the body where each is found.
(c) What happens to the excess amino acids obtained from proteins?

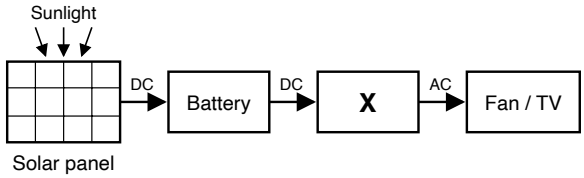
Answer (3 marks)

(a) Proteins are macromolecules formed by bonding together many amino acids. Proteins obtained from animal sources (such as milk and eggs) are called 'first class' proteins.
(b) Any two: haemoglobin and antibodies – blood; keratin – skin; ossein – bones; actin and myosin – muscles; insulin and trypsin – pancreas; various hormones – pituitary gland.
(c) Excess amino acids are not stored in the body. They are broken down and the ammonia formed is eliminated from the body. If necessary, they are converted into other useful substances such as glucose by gluconeogenesis.

Marking: (a) Definition ½ + animal origin ½ · (b) Two proteins with location – ½ mark each · (c) Not stored; broken down, ammonia removed / converted to glucose – 1 mark

Examiner tip: In (b) write the protein and its place together, e.g. 'haemoglobin – blood'.

(iii) A farmhouse near Ahmednagar uses the arrangement shown in the figure to run its fan and TV.
(a) Name the effect by which the solar panel produces electricity. Of which type of material are solar cells made?
(b) Why is the battery needed in this arrangement?
(c) Identify the device X and state why it is necessary.



Figure

Answer (3 marks)
(a) Solar photovoltaic effect – light energy in sunlight is converted directly into electrical energy (DC). Solar cells are made of a semiconductor, e.g. silicon.
(b) Solar cells produce electricity only when sunlight is available. To use the energy at other times (at night or on cloudy days), it is stored in the battery.
(c) X is an inverter. Solar cells give DC power, but most domestic appliances such as fans and TVs run on AC power. The inverter converts DC into AC.

Marking: (a) Photovoltaic effect ½ + semiconductor (silicon) ½ · (b) Electricity only in sunlight; stored for later use – 1 mark · (c) Inverter ½ + converts DC to AC needed by appliances ½

Examiner tip: Write 'DC to AC', not 'AC to DC'.

(iv) On a visit to the Alibag beach, students collected empty shells of snails and bivalves, and a fisherman showed them an octopus.
(a) To which phylum do these animals belong? Why is the phylum so named?
(b) Write any four characteristics of this phylum.

Answer (3 marks)
(a) Phylum Mollusca. The body of these animals is soft and slimy, hence they are called molluscs.
(b) Any four:
1. It is the second largest phylum of the animal kingdom.
2. They are aquatic or terrestrial; most aquatic molluscs are marine, a few live in fresh water.
3. The body is triploblastic, eucoelomate and non-segmented; except animals like the snail, the body shows bilateral symmetry.
4. The body is divided into head, foot and visceral mass.
5. The visceral mass is covered by a mantle, which secretes a hard calcareous shell; the shell may be external, internal or absent.
6. These animals are unisexual.

Marking: (a) Mollusca ½ + reason ½ · (b) Four characteristics – ½ mark each

Examiner tip: 'Soft body' is already the reason for the name; give four other points in (b).

(v) Every day a city like Nagpur collects hundreds of tonnes of degradable waste, which is disposed of at a modern landfill site.
(a) Why are the pits at a landfill site lined with plastic sheets?
(b) How is the waste decomposed in the pit and what useful product is finally obtained?
(c) Garbage vans now compress (compact) the waste before dumping it. Write one advantage of this.

Answer (3 marks)
(a) Large pits are dug in open spaces far away from residential areas and lined with plastic sheets so that toxic and harmful liquids from the waste do not leach into the soil (and ground water) and pollute it.
(b) Compressed waste is dumped in the pit and covered with layers of soil, saw dust, leafy waste and specific biochemicals (bioreactors are added at some places). Microbes present in the soil and these layers decompose the waste. The filled pit is sealed with soil slurry; after some time good quality compost (manure) is obtained, and the site can be reused.
(c) Any one: compaction reduces the volume of garbage, so more waste can be carried in one trip (fewer trips, less fuel and cost); more waste fits in one landfill pit, so the site fills more slowly and less land is needed.

Marking: (a) Prevent leaching of toxic liquids / soil pollution – 1 mark · (b) Decomposition by microbes in soil layers ½ + compost obtained ½ · (c) Any one advantage of reduced volume (more waste per trip / per pit, less land) – 1 mark

Examiner tip: In (b) mention that microbes decompose the waste; many students forget to name the final product, compost.

(vi) After a burglary in a house in Nashik, the police found a few hair roots and a drop of blood at the scene and sent them to a forensic laboratory.
(a) Which technique can establish the identity of the culprit from these samples? On what fact is it based?
(b) Write one more use of this technique.
(c) Name the institute in India where research on this technique is carried out.

Answer (3 marks)
(a) DNA fingerprinting. It is based on the fact that, like fingerprints, the DNA sequence of every person is unique. So a person can be identified from the DNA in any part of the body (hair root, blood, skin etc.) found at the scene of crime.
(b) It can establish the identity of the father of a child (paternity disputes). (It is mainly used in forensic science.)
(c) Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad.

Marking: (a) DNA fingerprinting ½ + DNA sequence of each person is unique ½ · (b) One more use – 1 mark · (c) CDFD, Hyderabad – 1 mark

Examiner tip: Do not confuse DNA fingerprinting with ordinary fingerprints taken with ink.

(vii) In July 2014, a huge landslide buried most of the houses of Malin village in Ambegaon taluka of Pune district. Rescue teams worked day and night; later, a new village and a new school building were built.
Considering the nature and scope of a disaster, name the three phases that are important for common citizens, and write one work done in each phase after such a landslide.

Answer (3 marks)
1. Phase of emergency – maximum lives can be saved by quick action: search and rescue of people trapped under debris, first aid and medical help, shifting people from the affected area, restoring communication.

2. Transitional phase – rehabilitation starts after the disaster subsides: clearing the debris, restoring water supply, repairing roads, giving monetary and other help to victims, providing a permanent means of livelihood.
3. Reconstruction phase – rebuilding houses, the school and other buildings, restoring roads and water supply, restarting farming. (It takes a long time.)

Marking: Phase of emergency ½ + one work ½ · Transitional phase ½ + one work ½ · Reconstruction phase ½ + one work ½

Examiner tip: Write the works in the correct phase; rebuilding houses is reconstruction, not emergency.

(viii) In some families boys are excused from household work while girls must do it 'to get used to it', and adolescent girls in society sometimes face teasing.
(a) What is social health?
(b) Write two factors that are important for good social health.
(c) How does such gender inequality affect girls? Give one more example of such discrimination at home.

Answer (3 marks)
(a) Social health is the ability of a person to establish relationships with other persons. The ability to change one's own behaviour according to changing social conditions is an important characteristic of social health.
(b) Any two: strong personality; having a large number of friends and relatives; proper use of time when alone and with the peer group; trust in others; respect and acceptance for others. (Factors shown in the textbook chart on social health, e.g. education, satisfying basic needs, social safety, may also be accepted.)
(c) Such gender inequality causes mental stress in girls, which harms their social health. Another example (any one): discrimination between brother and sister in the choice of fresh or left-over food, or in the medium of school education; many restrictions on girls while boys get excessive freedom.

Marking: (a) Definition – 1 mark · (b) Two factors – ½ mark each · (c) Causes mental stress ½ + one more example ½

Examiner tip: In (c) the example must be different from the one already given in the question.

Q.4 Answer the following questions. (Any one) **[5]**

(i) Read the following paragraph and answer the questions.
On a nature trail in the Bhimashankar Wildlife Sanctuary of Pune district, the forest guard told the students: "This sanctuary was set up mainly to protect the Shekru, the giant squirrel. It is a shy animal and is rarely seen. In this forest you can find hundreds of species of trees, birds, insects and fungi. Even among the mango trees of the nearby villages, which all belong to one species, no two trees give exactly the same fruit. Hunting and cutting of trees are not allowed here."
(a) What is biodiversity?
(b) Which level of biodiversity is shown by (1) hundreds of species of trees, birds, insects and fungi, (2) differences among mango trees of the same species?
(c) In which category of threatened species is the Shekru placed? Why?
(d) Give one example each of an endangered species and a rare species.
(e) Write two measures for conservation of biodiversity, other than those mentioned in the paragraph.

Answer (5 marks)
(a) The richness of living organisms in a region, due to the genetic differences among organisms of the same species, the many species of organisms and the various types of ecosystems, is called biodiversity.

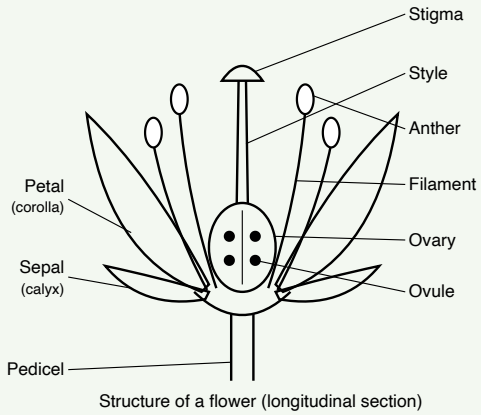
(b) (1) Species diversity. (2) Genetic diversity.
(c) Indeterminate species. It appears to be endangered, but because of its behavioural habits such as shyness, no definite and substantial information about it is available.
(d) Endangered species: lion-tailed monkey or lesser florican. Rare species: red panda or musk deer.
(e) Any two: protecting rare species of organisms; declaring some regions as bioreserves; starting projects for conservation of special species; conserving all plants and animals; maintaining a record of traditional knowledge.

Marking: (a) Definition – 1 mark · (b) Species diversity ½ + genetic diversity ½ · (c) Indeterminate ½ + shyness / no definite information ½ · (d) One endangered ½ + one rare ½ · (e) Two measures – ½ mark each

Examiner tip: In (c) do not write 'rare species' just because the Shekru is rarely seen; the textbook places it under indeterminate species. In (d) do not give the tiger or lion; the textbook places them under vulnerable species.

(ii) The flower is the functional unit of sexual reproduction in plants.
(a) Draw a neat labelled diagram showing the structure (longitudinal section) of a flower.
(b) Why are androecium and gynoecium called essential whorls?
(c) What is pollination? Name one abiotic agent and one biotic agent of pollination.
(d) The papaya flower is called unisexual, whereas the Hibiscus flower is called bisexual. Why?

Answer (5 marks)
(a) See the diagram. Labels: sepal (calyx), petal (corolla), anther and filament (stamen), stigma, style, ovary and ovules (carpel), pedicel.
(b) Androecium (stamens) and gynoecium (carpels) perform the function of reproduction, so they are called essential whorls. (Calyx and corolla only protect the inner whorls, so they are accessory whorls.)
(c) Transfer of pollen grains from the anther to the stigma of a carpel is called pollination. Abiotic agents: wind, water (any one). Biotic agents: insects, birds and other animals (any one).
(d) A Hibiscus flower has both androecium and gynoecium, so it is bisexual. A papaya flower has only one of these whorls – the male flower has only androecium and the female flower has only gynoecium – so it is unisexual.



Structure of a flower (longitudinal section)

Marking: (a) Correct diagram 1 mark + any four correct labels 1 mark · (b) They perform reproduction – 1 mark · (c) Definition ½ + one abiotic and one biotic agent ½ · (d) Hibiscus has both whorls ½ + papaya has only one whorl ½

Examiner tip: Show the ovules inside the ovary and the stigma at the tip of the style; label lines must touch the parts.

All the best for your exam!