

Get Ready to Crack CSIR-NET 2021 (Most Important Questions Applied Biology)



1. Tetracycline is used to treat infections caused by bacteria including pneumonia and other respiratory tract infections. Which of the following microorganism produce this antibiotic?

- A) *Bacillus brevis*
- B) *Penicillium chrysogenum*
- C) *Nocardia mediterranei*
- D) *Streptomyces aureofaciens*

2. Match the following fermentative enzyme produced with corresponding bacteria

- P. Pectinase - 1. *Pseudomonas aeruginosa*
- Q. Invertase - 2. *Bacillus subtilis*
- R. Protease - 3. *Aspergillus niger*
- S. Cellulase - 4. *Saccharomyces cerevisiae*

- A) P- 3, Q -4, R – 1,S- 2
- B) P-2,Q-3,R-1, S-4
- C) P-3,Q-2,R-4,S-1
- D) P-4, Q-1,R-2,S-3

3. Which of the following is the precursor of 6-APA (6-amino penicillanic acid)?

- A) Penicillin G
- B) Penicillin K
- C) Amphicilin
- D) Cephalosporin

4. Ergot alkaloids are a diverse group of small nitrogen-containing organic compounds produced by certain plants and microorganisms. Which of the following fungus is an important producer of ergots?

- A) *Psilocybe cubensis*
- B) *Agaricus bisporus*
- C) *Amanita phalloides*
- D) *Claviceps purpurea*

5. Which type of fermentation process is the commonly employed technique for citric acid production?

- A) Solid-state fermentation
- B) Submerged fermentation
- C) Aerobic fermentation
- D) Anaerobic fermentation

6. Which of the following industrial strains are used for fermentative production of vitamin B12?

- A) *Pseudomonas denitrificans* and *Propionibacterium freudenreichii* subsp.
- B) *E.coli* and *Bacillus subtilis*
- C) *Lactobacillus* and *Streptococcus*
- D) *Corynebacterium glutamicum* and *Brevibacterium flavum*

7. Match the following organism and substrate used for single-cell protein production

- P. *Saccharomyces cerevisiae* - i. N- alkanes
- Q. *Nocardia sp.* - ii. Molasses
- R. *Chlorella pyrenoidosa* - iii Methanol
- S. *Methylomonas clara* - iv CO₂ (10%), light

- A) P-ii, Q- i, R- iv, S-iii
- B) P-iii, Q- ii, R- i, S-iv
- C) P-i,Q-iv, R-ii, S-iii
- D) P-iv,Q-i,R- iii, S-ii

8. Which of the following statements about Somatic embryogenesis is incorrect.

P. Somatic embryogenesis refers to the process in which somatic or non-sexual cells are induced to form bipolar embryos through a series of developmental steps similar to those occurring during in vivo embryogenesis.

Q. Somatic embryo formation has been achieved for a variety of plant species, including angiosperms and gymnosperms.

R. Somatic embryogenesis is same as organogenesis in that regeneration and organization are bipolar; the shoots and roots meristems are formed simultaneously from a group of cells (proembryonic masses).

S. Somatic embryogenesis is often favoured by cultured in an agitated liquid medium.

T. It lengthens the breeding cycle of deciduous trees and increases the germination of hybrid embryos.

- A) P,Q,R
- B) R,T
- C) R,S,T
- D) P,Q,S,T

9. Statements for synthetic seeds are given below. Identify correct statement

P. Synthetic seeds are living seed-like structures derived from somatic embryoids after encapsulation by a hydrogel. Such preserved embryos are called as synthetic seeds.

Q. These seeds are vulnerable to unfavourable field conditions including microbial contamination, without desiccation.

R. Encapsulated seeds are used as substitutes for natural seeds and can be grown directly in green house or fields.

S. Examples of plants produced from synthetic seeds are *Apium graveolens*, *Brassica sps.*, *Gossypium hirsutum*, *Medicago sativa*, *Oryza sativa*, *Zea mays*, *Daucos carota* and *Medicago sativa*.

- A) P,S
- B) P,Q,S
- C) P,R,S
- D) S only

10. Which of the following statement is incorrect regarding HAT selection?

P. HAT Medium (hypoxanthine-aminopterin-thymidine medium) is a selective medium for mammalian cell culture, which relies on the combination of aminopterin, hypoxanthine and thymidine.

Q. Aminopterin blocks DNA *de novo* synthesis, which is required for cell division to proceed, but hypoxanthine and thymidine provide cells with the raw material to evade the blockage of the salvage pathway.

R. Myeloma cells grow in HAT medium as these cells contain HGPRT.

S. Hybrid cell survive in HAT medium as it inherits HGPRT from B cells

Answer

1. D

6. A

2. A

7. A

3. A

8. B

4. D

9. C

5. B

10. C

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Solutions:

1. Tetracyclines constitute a large group of broad-spectrum antibiotics obtained by fermentation of a specific bacteria *Streptomyces aureofaciens* e *Streptomyces rimosus* (tetracycline, chlortetracycline and oxytetracycline) of actinobacteria. It exerts a bacteriostatic effect on bacteria by binding reversible to the bacterial 30S ribosomal subunit and blocking incoming aminoacyl tRNA from binding to the ribosome acceptor site.
2. Microbes are capable of engineering the production of these chemicals. In recent years, microbial fermentations have been revolutionized by the application of genetically engineered organisms.
3. Penicillin G, is converted to 6-APA and phenylacetic acid hydrolyzed by penicillin acylase (PA). The 6-APA is then chemically acylated with an appropriate side chain to produce semisynthetic penicillin. Consequently, as 6-APA can also serve as a precursor of cephalosporins, it is often used as the starting material for their semisynthetic production. A base natural penicillin is converted to 6-APA.
4. Ergot alkaloids are potent α -blockers that cause direct smooth muscle contraction. They are products of the **fungus *Claviceps purpurea***. Species of the filamentous fungus *Claviceps*, which are pathogens of grasses, produce a range of alkaloids. Some of the best known is the ergot alkaloids. These compounds are produced within the sclerotia (fruiting bodies) of *Claviceps purpurea* that develop naturally when this organism infects developing cereal grains. Infected grains become black and are referred to as ergots.
5. The submerged fermentation (SMF) process is the commonly employed technique for citric acid production. It is estimated that about 80% of world production is obtained by SMF. Several advantages such as higher yields and productivity and lower labour costs are the main reasons for this.
6. Industrial production of B₁₂ is achieved through the fermentation of selected microorganisms. The species *Pseudomonas denitrificans* and *Propionibacterium freudenreichii subsp.* is exclusively used as an industrial strain for the production of vitamin B12 under aerobic conditions
7. Algae (eg: *Chlorella*) which contain chlorophylls, do not require organic wastes. They use free energy from sunlight and carbon dioxide from air, while bacteria

(except photoautotrophs) require raw materials like sugars, refined petroleum products like methanol (eg: *Methylomonas clawichra*) and fungi require organic wastes.

8. Somatic embryogenesis is different from organogenesis in that regeneration and organization are bipolar; the shoots and roots meristems are formed simultaneously from a group of cells (proembryonic masses). As with organogenesis, differentiation, morphogenesis and organization of somatic embryo takes place directly in the explant or from the callus. It shortens the breeding cycle of deciduous trees and increases the germination of hybrid embryos.

9. Synthetic seeds are seeds that can resist unfavourable field conditions including microbial contamination, without desiccation. Such encapsulated seeds are used as substitutes for natural seeds and can be grown directly in greenhouse or fields.

10. The production of monoclonal antibodies was first invented by César Milstein and Georges J. F. Köhler. The technology is called hybridoma technology. HAT medium is used for the preparation of monoclonal antibodies. This process is called hybridoma technology. Laboratory animals (e.g., mice) are first exposed to an antigen against which we are interested in isolating an antibody. Once splenocytes are isolated from the mammal, the B cells are fused with HGPRT (hypoxanthine-guanine phosphoribosyltransferase) negative, immortalized myeloma cells using polyethylene glycol or the Sendai virus. Fused cells are incubated in the *HAT medium*. Aminopterin blocks the pathway that allows for nucleotide synthesis. Hence, **unfused myeloma cells** die, as they cannot produce nucleotides by the de novo or salvage pathways because they lack HGPRT.

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