

## **BOTANY - SECTION A**

**1** Assertion (A): Somatic embryo is also called non-zygotic embryo.

Reason (R): Zygote is not involved in somatic embryo formation.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**2** Assertion (A): Single Cell Protein (SCP) is an alternative source to help the increasing demand of growing population.

Reason (R): SCP can be produced at a fast rate and is cost effective.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**3** Mutation breeding has been used to create:

- I. Mung bean variety resistant to yellow mosaic virus
- II. Abelmoschus variety resistant to yellow mosaic virus

1. Only I
2. Only II
3. Both I and II
4. Neither I nor II

**4** The success of improving a crop by plant breeding largely depends on:

1. Effective germplasm collection
2. Somatic hybridization
3. Somaclonal variations
4. Induced mutations

**5** IPM stands for

1. Integrated Pest Management
2. Integrated Part Messenger
3. International Pollution Management
4. Inter- Pesticide Management Committee

**6** Pusa shubhra is a variety of

1. Cauliflower resistant to white rust
2. Cauliflower resistant to black rot
3. Chilli resistant to chilli mosaic virus
4. Brassica resistant to white rust

**7** In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called

1. selection of superior recombinations
2. cross-hybridisation among the selected parents
3. evaluation and selection of parents
4. germplasm collection

**8** Select the correct group of biocontrol agents:

1. *Nostoc*, *Azospirillum*, *Nucleopolyhedrovirus*
2. *Bacillus thuringiensis*, Tobacco mosaic virus, Aphids
3. *Trichoderma*, Baculovirus, *Bacillus thuringiensis*
4. *Oscillatoria*, *Rhizobium*, *Trichoderma*

**9** Arrange the following steps of a plant breeding program in a correct chronological manner:

- I. Selection and testing of superior recombinants
- II. Collection of variability
- III. Cross-hybridization among the selected parents
- IV. Evaluation and selection of parents
- V. Testing, release and commercialization of new cultivars

1. II, IV, I, III, V
2. IV, I, II, III, V
3. II, IV, III, I, V
4. IV, III, II, I, V

**10** Assertion: Whole plants can be regenerated from any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media

Reason: Every living plant cell is totipotent

1. Both assertion and reason are true and the reason is the correct explanation of the assertion
2. Both assertion and reason are true but the reason is not the correct explanation of the assertion
3. Assertion is true but reason is false
4. Both assertion and reason are false

**11** Assertion (A): Wild crop varieties must be conserved and protected.

Reason (A): These plants serve as an important source of valuable genes like those of insect and pathogen resistance.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**12** Which scientist, given in Column I, is not correctly matched with the contribution given in Column II?

1.	Norman Borlaug	Blue revolution
2.	Florey and Chain	Established penicillin for commercial use
3.	Cohen and Boyer	Recombinant DNA technology
4.	Fred Sanger	Human genome sequencing

**13** Assertion (A): Biofortification is the most practical mean to improve public health.

Reason (R): It is the breeding of crops with higher levels of vitamins or minerals or higher protein and healthier fat.

- Both (A) and (R) are true and (R) is the correct explanation of (A)
- Both (A) and (R) are true and (R) is not the correct explanation of (A)
- (A) is true, (R) is false
- (A) is false, (R) is true

**14**

*Trichoderma harzianum* has proved to be a useful micro-organism for

- bioremediation of contaminated soils
- reclamation of wastelands
- gene transfer in higher plants
- biological control of soil-borne plant pathogens

**15** Plants generated through micropropagation are:

- Somatic hybrids
- Embryoids
- Somaclones
- Explants

**16** Match List I with List II

List I	List II
A. Wheat - Himgiri	I. Black rot and Curl
B. Brassica - Karan rai	II. Bacterial blight
C. Cauliflower - Pusa Shubhra	III. White rust
D. Cow pea - Pusa Komal	IV. Leaf and stripe rust, hill blight

Choose the correct answer from the options given below:

- A-IV B-III C-I D-II
- A-III B-II C-I D-IV
- A-II B-IV C-III D-I
- A-I B-III C-II D-IV

**17** Which of the following is not correct?

- More than 840 million people in the world do not have adequate food to meet their daily food and nutritional requirements.
- Three billion people suffer from micronutrient, protein and vitamin deficiencies or hidden hunger because they are not able to buy enough fruits, vegetables, legumes, fish and meat
- High Aspartate, low sugar content and high nitrogen content in maize leads to resistance to maize stem borers.
- Breeding methods for insect pest resistance involve the same steps as those for any other agronomic trait such as yield or quality.

**18** Select the **incorrect** statement with respect to SCP

- Alternate source of proteins for human and animal nutrition
- Can be grown on waste material
- Decreases environmental pollution
- Methylophilus methylotrophus* can be expected to produce 250 tonnes of protein.

**19** In virus-infected plants, the meristematic tissues in both apical and axillary buds are free of virus because

- the dividing cells are virus resistant
- meristems have antiviral compounds
- the cell division of meristems are faster than the rate of viral multiplication
- viruses cannot multiply within meristem cell(s)

**20** *Bacillus thuringiensis* (Bt) strains have been used for designing novel -

1. Bioinsecticidal plants
2. Bio-mineralization processes
3. Biofertilizers
4. Bio-metallurgical techniques

**21** The list of traits that breeders try to incorporate into crop plants should lead to

1. Increased tolerance to environmental stresses
2. Resistance to pathogens
3. Tolerance to insect pests
4. Increased crop yield and improved quality

**22** Which of the following is not correct?

1. A wide range of fungal, bacterial, and viral pathogens affect the yield of cultivated crop species, especially in tropical climates.
2. Crop losses can often be significant, up to 20-30% or even 100%.
3. Hybrid breeding has led to the development of several high yielding varieties resistant to water stress.
4. The disease-resistant varieties increase our dependence on the use of fungicides and bacteriocides.

**23** Among the following pairs of microbes, which pair has both the microbes that can be used as biofertilizers?

1. *Aspergillus* and *Rhizopus*
2. *Rhizobium* and *Rhizopus*
3. Cyanobacteria and *Rhizobium*
4. *Aspergillus* and Cyanobacteria

**24** KVIC stands for

1. Khadi and village Institution commission
2. Khadi and Vellore institution commission
3. Khadi and Village Industries commission
4. Kanpur and Vallore industries Commission

**25** In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called :

1. cross-hybridisation among the selected parents.
2. evaluation and selection of parents.
3. germplasm collection.
4. selection of superior recombinants.

**26** Baculoviruses have no negative effect over

1. Plants, fish
2. Mammals
3. Birds, non-target insects
4. All of the above

**27** Which one of the following statement is **wrong**?

1. Gene norin 10 was reported in Japan
2. IR-8 was developed at IRRI
3. *Saccharum barberi* was originally grown in North India
4. *Saccharum officinarum* has lower sugar content

**28** Choose the biofortified crop among these

1. Atlas 66 – Wheat
2. Pusa A-4 – Bhindi
3. Pusa Sadabahar – Chilli
4. Jaya – Rice

**29** Which one of the following combinations would a sugarcane farmer look for in the sugarcane crop?

1. Thick stem, long internodes, high sugar content and disease resistance
2. Thick stem, high sugar content and profuse flowering
3. Thick stem, short internodes, high sugar content, disease resistance
4. Thick stem, low sugar content and disease resistance

**30** Which of the following is not an important part of biological farming approach?

1. To know all the life forms that inhabit the field
2. Predators and pests are also analysed
3. The life cycles, patterns of feeding and habitats of all the life forms of that field are analysed
4. To know the abundance of each of the life forms

**31** Mycorrhiza does not help the host plant in

1. enhancing its phosphorus uptake capacity
2. increasing its tolerance to drought
3. enhancing its resistance to root pathogens
4. increasing its resistance to insects

**32** Consider the following four statements (I-IV) and select the option which includes all the correct ones only :

I.	Single cell <i>Spirulina</i> can produce large quantities of food rich in protein, minerals, vitamins etc.
II.	Body weight-wise, the microorganism <i>Methylophilus methylotrophus</i> may be able to produce several times more proteins than that produced by a cow per day through its milk.
III.	Common button mushrooms are a very rich source of vitamin C.
IV.	A rice variety has been developed which is very rich in calcium.

1. Statements (I), (III) and (IV)
2. Statements (II), (III) and (IV)
3. Statements (I), (II)
4. Statements (III), (IV)

**33** Assertion (A): Biofertilizers are preferred over chemical fertilizers.

Reason (R): Chemical fertilizers are more hazardous to the environment.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**34** Select the incorrect statement with respect to inbreeding of animals.

1. It is used for evolving pure lines in cattle.
2. It helps in accumulation of superior genes and elimination of less desirable genes.
3. It decreases homozygosity.
4. It exposes harmful recessive genes that are eliminated by selection

**35** Assertion (A): Most of the orchid species seedlings cannot proceed with development in the absence of symbiotic fungi.

Reason (R): Lichens contain symbiotically associated fungi.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

## BOTANY - SECTION B

**36** Clearing of bottled fruit juices is achieved by treatment with:

1. Lipases and Proteases
2. DNase and RNase
3. Proteases and Pectinases
4. Cellulase and Chitinase

**37** Assertion (A): In plant tissue culture, somatic embryos can be induced from any plant cell.

Reason (R): Any viable plant cell can differentiate into somatic embryos.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**38** Read the given statements and select the correct option:

A - *Trichoderma* is an effective biocontrol agent of several plant pathogens.

B - *B. thuringiensis* is effective against larvae of bollworm.

1. Both A and B are correct
2. Both A and B are incorrect
3. Only A is correct
4. Only B is correct

**39** Assertion (A): Virus free plants can be produced from meristem tissue culture.

Reason (R): Viruses fail to grow during the growth of meristem.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**40** The development of diseases in a plant depends on the interaction among following factors:

1. Host genotype and environment
2. Pathogen genotype and host genotype
3. Pathogen genotype and environment
4. Host genotype, pathogen genotype and environment

**41** Which of the following does not involve a fungus?

1. Commercial production of ethanol
2. Commercial production of citric acid
3. Commercial production of statins
4. Commercial production of streptokinase

**42** Which of the following statement is wrong?

1. 2.5 g of *Methylophilus methylotrophus* can be expected to produce 0.25 tonnes of protein per day
2. Hybrid breeding has led to the development of several high yielding varieties of millets resistant to water stress
3. Brown rust of wheat and black rot of crucifers diseases are caused by fungal pathogens
4. Smooth leaved and nectar-less cotton varieties do not attract bollworms

**43** *Bt* as a Biocontrol measure holds true for which of the following options?

1. Available in sachets as dried spores
2. Sprayed on vulnerable plants such as Brassicas and Dahlia
3. Kills butterfly caterpillars and other insects
4. All of these

**44** Totipotency refers to

1. capacity to generate genetically identical plants.
2. capacity to generate a whole plant from any plant cell / explant.
3. capacity to generate hybrid protoplasts.
4. recovery of healthy plants from diseased plants.

**45** State true (T) or false (F) for the following statements and select the correct option.

- A. Breeding of crops with high levels of minerals, vitamins and proteins is called biofortification
- B. Ratna developed for green revolution is a variety of rice

	A	B
1.	T	F
2.	F	T
3.	F	F
4.	T	T

**46** Consider the following statements:

I:	Hairy leaves are associated with resistance to jassids in cotton and cereal leaf beetle in wheat.
II:	Low aspartic acid, high nitrogen, and sugar content in maize leads to resistance to maize stem borers.
III:	In wheat, solid stems lead to non-preference by the stem sawfly and smooth-leaved and nectar-less varieties of cotton do not attract bollworms.

Which of the above statements are true?

1. I and II only
2. I and III only
3. II and III only
4. I, II and III

**47** Read the following statements:

- (i) *Trichoderma* is a symbiotic algae which is common in root ecosystems and effective against several plant pathogens
- (ii) Dragonflies are biocontrol agents
- (iii) *Bacillus thuringiensis* spores are mixed in alcohol and sprayed to vulnerable plants like brassicas and fruit trees
- (iv) Baculoviruses attack arthropods and other insects
- (v) *Nucleopolyhedrovirus* (NPV) have species-specific, broad spectrum insecticidal applications

Which of the above statements are correct?

1. (i) and (iii)
2. (ii), (iii) and (iv)
3. (ii) and (v)
4. (ii) and (iv)

**48** Citric acid, widely used in food industry, can be commercially produced with the help of the microbe:

1. *Propionibacterium shermanii*
2. *Aspergillus niger*
3. *Xanthomonas citri*
4. *Colletotrichum falcatum*

**49** Three billion people world-wide suffer from 'hidden hunger'. This 'hidden hunger' relates to the people:

1. whose diet shows deficiency in proteins, vitamins and micronutrient
2. who cannot afford to buy adequate vegetables, fruits, legumes, fish and meat
3. whose food does not contain essential micronutrients specially iron, iodine, zinc and vitamin-A
4. all of the above

**50** Which one of the following is an example of carrying out biological control of pests/diseases using microbes?

1. *Trichoderma* sp. against certain plant pathogens
2. *Nucleopolyhedrovirus* against white rust in Brassica
3. Bt-cotton to increase cotton yield
4. Ladybird beetle against aphids in mustard

## ZOOLOGY - SECTION A

**51** Inbreeding depression is -

1.	Reduced motility and immunity due to close inbreeding
2.	Decreased productivity due to mating of superior male and inferior female
3.	Decrease in body mass of progeny due to continued close inbreeding
4.	Reduced fertility and productivity due to continued close inbreeding

**52** Given below are two statements:

Statement I: Immature lymphocytes differentiate into antigen sensitive lymphocytes in primary lymphoid organs and then migrate to secondary lymphoid organs

Statement II: In Peyer's patches of the small intestine, lymphocytes interact with antigens and proliferate to become effector cells

In light of the above statements, choose the most appropriate answer from the options given below:

1. Both Statement I and Statement II are correct
2. Both Statement I and Statement II are incorrect
3. Statement I is correct but Statement II is incorrect
4. Statement I is incorrect but Statement II is correct

**53** Match column-I with column-II and find the correct match

	Column-I		Column-II
a.	Physical barrier	(i)	Interferons
b.	Physiological barrier	(ii)	Polymorpho-nuclear leukocytes
c.	Cellular barrier	(iii)	Acid in stomach
d.	Cytokine	(iv)	Mucus lining of urogenital tract

1. a-iv, b-iii, c-ii, d-i
2. a-iv, b-iii, d-i, c-ii
3. b-iii, c-ii, d-iv, a-i
4. b-iii, c-i, d-ii, a-iv

**54** Which of the following is responsible for graft rejection?

1. Cell mediated immunity
2. Innate immunity
3. Leukocytes and the cellular barriers
4. Interferons

**55** Select the incorrect statement regarding inbreeding:

1. Inbreeding helps in elimination of deleterious alleles from the population
2. Inbreeding is necessary to evolve a pure-line in any animal
3. Continued inbreeding reduces fertility and leads to inbreeding depression.
4. Inbreeding depression cannot be overcome by out-crossing.

**56** In a sewage treatment plant (STP), the primary treatment is a \_\_\_\_ (A) \_\_\_\_ which involves removal of small and large particles from sewage through \_\_\_\_ (B) \_\_\_\_ and \_\_\_\_ (C) \_\_\_\_.

	A	B	C
1.	Physical process	Filtration	Sedimentation
2.	Chemical process	Filtration	Sedimentation
3.	Biological process	Filtration sedimentation	Sedimentation
4.	Biological process	Microbial digestion	Sedimentation



**57** Read the statements given below with respect to disease-causing microbes.

- All parasites are pathogens as they cause harm to the host.
- Pathogens have to adapt to life within the environment of the host.
- Pathogen of dysentery lives in the gut of host organism.
- Pathogens can enter human body by various means causing functional damage but do not interfere with normal vital activities.

Select the option that contains correct statements:

- (a) and (b) only
- (b) and (c) only
- (a), (b) and (d) only
- (a), (b), (c) and (d)

**58** Which of the following is a correct combination of a disease, its causative organism and mode of infection?

- Typhoid fever - *Salmonella typhi* - sexual transmission
- Pneumonia - *Haemophilus influenzae* - droplet infection
- Malaria-*Plasmodium falciparum* - contaminated food and water
- Filariasis - *Wuchereria bancrofti* - bite of female *Anopheles* mosquito

**59** What gases are produced in anaerobic sludge digesters?

- Methane and CO<sub>2</sub> only
- Methane, Hydrogen sulphide and CO<sub>2</sub>
- Methane, hydrogen sulphide and O<sub>2</sub>
- Hydrogen sulphide and CO<sub>2</sub>

**60** Match List I with List II

List I	List II
A. <i>Haemophilus influenzae</i>	I. Common cold
B. Rhino virus	II. Elephantiasis
C. <i>Wuchereria malayi</i>	III. Pneumonia
D. <i>Plasmodium falciparum</i>	IV. Malignant malaria

Choose the correct answer from the options given below:

- A-III, B-I, C-II, D-IV
- A-I, B-II, C-III, D-IV
- A-III, B-IV, C-II, D-I
- A-I, B-III, C-II, D-IV

**61** Which of the following is correctly matched for the product produced by them?

- Acetobacter aceti* : Antibiotics
- Methanobacterium* : Lactic acid
- Penicillium notatum* : Acetic Acid
- Saccharomyces cerevisiae* : Ethanol

**62** Assertion(A): Colostrum is important for the immunity of new-borns as it protects them against infections

Reason (R): Colostrum is rich in immunoglobulin (IgA)

- Both (A) and (R) are true and (R) is the correct explanation of (A)
- Both (A) and (R) are true and (R) is not the correct explanation of (A)
- (A) is true, (R) is false
- (A) is false, (R) is true

**63** Interspecific hybridisation is the mating of

- animals within the same breed without having common ancestors
- two different related species
- superior males and females of different breeds
- more closely related individuals within the same breed for 4-6 generations

**64** Read the statements given below carefully with respect to ringworm:

- It is one of the most common non-infectious diseases in man.
- Neurospora* belongs to the same kingdom to which the organisms causing ringworm infection belong.
- Heat and moisture helps the infection to spread.

Select the correct option.

- Statements (a) and (b) are correct while statement (c) is incorrect.
- Statements (b) and (c) are correct while statement (a) is incorrect.
- Statements (a) and (c) are correct while statement (b) is incorrect.
- Statements (a), (b) and (c) are correct.

**65** Read the following steps involved in multiple ovulation embryo transfer technology.

- Fertilized eggs are transferred to surrogate mothers at 8-32 cells stages
- Cow is administered FSH-like hormone for superovulation
- Cow yields about 6-8 eggs at a time
- Cow is fertilized by artificial insemination

Choose the option which represents correct sequence of above steps involved in MOET.

- (a) → (b) → (c) → (d)
- (b) → (c) → (d) → (a)
- (a) → (d) → (c) → (b)
- (b) → (c) → (a) → (d)

**66** Following are the stringent measures taken in the dairy farm management. Choose the incorrect measure:

- Selection of good breeds having high yielding potential, combined with resistance to diseases.
- The feeding of cattle should be carried out in a scientific manner – with special emphasis mainly on the quantity of fodder only.
- Regular inspections with proper record keeping that would help to identify and rectify the problems as early as possible.
- Cleanliness and hygiene is of paramount importance while milking, storage and transport of milk and its products.

**67** The form of malarial parasite that is infectious to the humans can be found in

- Salivary glands of freshly moulted female Anopheles mosquito
- Only in RBCs of a human suffering from malaria
- Gut of an infected female Anopheles
- Saliva of an infected female Anopheles mosquito

**68** Match the following list of microbes and what they are used for:

A.	Saccharomyces cerevisiae	1.	Production of immuno suppressive agents
B.	Monascus purpureus	2.	Ripening of Swiss cheese
C.	Trichoderma polysporum	3.	Commercial production of ethanol
D.	Propionibacterium shermanii	4.	Production of blood-cholesterol lowering agents

- A-3 B-4 C-1 D-2
- A-4 B-3 C-2 D-1
- A-4 B-2 C-1 D-3
- A-3 B-1 C-4 D-2

**69** Identify the incorrect match among the following

	Disease	Vector
1.	Elephantiasis	- Female Culex
2.	Dengue	- Female Aedes
3.	Chikungunya	- Musca domestica
4.	Malaria	- Anopheles mosquito

**70** Read the statements A and B carefully and select the correct option.

Statement (A): Among non-infectious diseases, cancer is the major cause of death all over the globe.

Statement (B): Malignant malaria caused by Plasmodium malariae is the most serious one.

- Statements (A) and (B) are correct
- Statements (A) and (B) are incorrect
- Only statement (A) is correct
- Only statement (B) is correct

**71** The term 'Blue Revolution' is related with :

- Various crop plants and their by-products
- Development of water reservoirs
- Honey and its by-products
- Fishery industry

**72** Assertion (A): Wine and beer are 'soft' liquors whereas whisky, brandy, rum and vodka are 'hard' liquors.

Reason (R): Wine and beer are processed without distillation whereas as whisky, brandy, rum and vodka are processed by distillation.

- Both (A) and (R) are true and (R) is the correct explanation of (A)
- Both (A) and (R) are true and (R) is not the correct explanation of (A)
- (A) is true, (R) is false
- (A) is false, (R) is true

**73** The treatment of snakebite by antitoxin is an example of

- Artificially acquired active immunity
- Artificially acquired passive immunity
- Naturally acquired passive immunity
- Specific natural immunity

**74** Choose the option which includes only sexually transmitted bacterial diseases:

- Amoebiasis, Hepatitis-B, Tuberculosis
- Elephantiasis, Ascariasis, AIDS
- Hepatitis-B, Genital herpes, Genital warts
- Gonorrhoea, Syphilis, Chancroid



**75** Select the incorrect match.

1. Morchella esculenta – Hallucinogen
2. Psoriasis – Autoimmune disease
3. Diphtheria – DPT vaccine
4. Whooping cough – Killed bacterial vaccine

**76** The technology of biogas production from cow dung was developed in India largely due to the efforts of

1. Gas Authority of India
2. Oil and Natural Gas Commission
3. Indian Agricultural Research Institute, Khadi and Village Industries Commission
4. Indian Oil Corporation

**77** Read the following statement having two blanks (A and B) :

"A drug used for \_\_\_\_\_ (A)\_\_\_\_\_ patients is obtained from a species of the organism \_\_\_\_\_(B)\_\_\_\_\_".

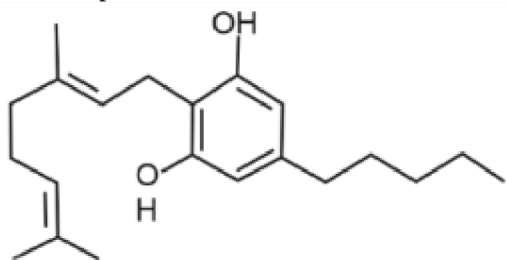
The one correct option for the two blanks is :

- | Blank-A             | Blank-B            |
|---------------------|--------------------|
| 1. AIDS             | <i>Pseudomonas</i> |
| 2. Heart            | <i>Penicillium</i> |
| 3. Organ-transplant | <i>Trichoderma</i> |
| 4. Swine flu        | <i>Monascus</i>    |

**78** Ram has the habit of consuming fruits and vegetables without washing properly as well as drinking contaminated water, but one day, he suffered from fever and he went to doctor for his treatment. Doctor observed other symptoms also like anemia, internal bleeding and blockage of intestinal passage. Identify the disease through which Ram would be suffering.

1. Ascariasis
2. Pneumonia
3. Amoebiasis
4. Typhoid

**79** Identify the given molecule and select the incorrect option with respect to it.



1. Its receptors are present principally in the brain
2. It is taken by inhalation and oral ingestion
3. It is obtained from *Papaver somniferum*
4. It affects cardiovascular system of the body

**80** Big holes in Swiss cheese are made by a

1. a machine
2. a bacterium that produces methane gas
3. a bacterium producing a large amount of carbon dioxide
4. a fungus that releases a lot of gases during its metabolic activities

**81** Apiculture is helpful in all of the following except

1. Producing beeswax
2. Enhancing crop yield
3. Producing venom
4. Increasing pollination of crops like rice, wheat, etc.

**82** Allergy is an exaggerated immune response towards antigens present in the environment. Which of the following antibodies are produced in response to these substances?

1. IgE
2. IgA
3. IgM
4. IgG

**83** Read the statements given below with respect to cannabinoids carefully.

- a. They interact with cannabinoid receptors present principally in GIT.
- b. They are naturally obtained from inflorescences of the plant *Cannabis sativa*.
- c. They can be used as medicine to overcome the pain.
- d. They can increase heart rate.

How many of the statements given above are correct?

1. One
2. Two
3. Three
4. Four

**84** Which of the following statements about methanogens is not correct?

1. They can be used to produce biogas.
2. They are found in the rumen of cattle and their excreta.
3. They grow aerobically and breakdown cellulose-rich food.
4. They produce methane gas.

**85** How many of the following diseases given below in the box are arthropod vector borne diseases?

Dengue, Chikungunya, Filariasis, Ascariasis, Small pox, Tetanus.

1. Three
2. Four
3. Five
4. Six

## ZOOLOGY - SECTION B

**86** Which of the following step immediately precedes artificial insemination in MOET?

1. Superovulation in superior breed of surrogate mother
2. Non-surgical transfer of embryo at 8-32 cell stage
3. Mating with an elite bull
4. Injection of FSH like hormone in genetic mother

**87** Apis mellifera are killer bees possessing toxic bee venom. Identify the treatment and the type of immunity developed from the given table to treat a person against the venom of this bee.

	Remedy	Immunity
1.	Inactivated proteins	Active
2.	Proteins of the venom	Passive
3.	Preformed antibodies	Passive
4.	Dead micro-organisms	Active

**88** Consider the statements given below

- (a) An antitoxin provides active immunity
- (b) Vaccine against whooping cough is an example of killed bacterial vaccine
- (c) Hepatitis B vaccine has been produced by recombinant DNA technology
- (d) Performed antibodies are required to treat the bite of a viper snake

Select the option including correct statements only:

1. (a), (b) and (c) only
2. (a), (c) and (d) only
3. (b), (c) and (d) only
4. (a), (b), (c) and (d)

**89** State the following given statements either as true (T) or false (F) with respect to cancer.

(A)	Non-ionizing radiations like X-rays and $\gamma$ -rays cause DNA damage leading to neoplastic transformation.
(B)	MRI plays a significant role in detecting cancers of internal organs.
(C)	Cellular oncogenes are inactivated under UV-rays leading to oncogenic transformation of cells.

Select an appropriate option:

	(A)	(B)	(C)
1.	F	T	T
2.	F	F	T
3.	F	T	F
4.	T	F	F

**90** Select an improved breed of cattle among the given options.

1. Jersey
2. Leghorn
3. Mule
4. Hisardale

**91** Read the statements and select the correct option.

Statement-A: Inbreeding exposes harmful recessive genes that are eliminated by selection.

Statement-B: Hisardale is a new breed of sheep developed in Punjab by interspecific hybridisation.

1. Only statement A is correct
2. Only statement B is correct
3. Both statements A and B are correct
4. Both statements A and B are incorrect

**92** High value of BOD (Biochemical Oxygen Demand) indicates that:

1. water is highly polluted
2. water is less polluted
3. consumption of organic matter in the water is higher by the microbes
4. water is pure

**93** Select the examples of active immunity.

- a. Immunoglobulin transmitted through mother's milk
  - b. Immunoglobulin injected in a patient
  - c. Attenuated pathogens introduced in the body
  - d. Administration of anti-venom
1. a, b, c and d
  2. a, b and d
  3. a and d only
  4. c only

**94** Select the correct option to complete the analogy with respect to cancer detection:

Use of X-rays: Radiography: :Use of non-ionising radiations :\_\_\_\_\_

1. MRI
2. Radiography
3. Computed tomography
4. Biopsy

**95** Assertion (A): While working on *Staphylococci*, Alexander Fleming observed that *Penicillium notatum* inhibits the growth of the bacteria.

Reason (R): This inhibiting chemical was commercially extracted and its full potential was established by Alexander Fleming.

1. Both (A) and (R) are true and (R) is the correct explanation of (A)
2. Both (A) and (R) are true and (R) is not the correct explanation of (A)
3. (A) is true, (R) is false
4. (A) is false, (R) is true

**96** "The activated sludge is pumped into large tanks. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge". In which tank, this process of sewage treatment is performed?

1. Secondary settling tank
2. Aeration tank
3. Primary settling tank
4. Anaerobic sludge digesters

**97** Select the correct statement from the following

1. Activated sludge-sediment in settlement tanks of sewage treatment plant is a rich source of aerobic bacteria
2. Biogas is produced by the activity of aerobic bacteria on animal waste
3. *Methanobacterium* is an aerobic bacterium found in rumen of cattle
4. Biogas, commonly called gobar gas, is pure methane

**98** Which statement is true?

1. Antibiotics are produced by bacteria only
2. Antibiotics can be produced by bacteria and fungi
3. Antibiotics usually affect the fungal cells
4. Both (1) and (3)

**99** How many of the changes given below are indicative of metastatic tumor?

- (a) Loss of contact inhibition
  - (b) Destruction of telomerase inhibitors
  - (c) Less production of telomerase
  - (d) Inactivation of proto-oncogenes
1. Four
  2. Three
  3. Two
  4. One

**100** The domestic sewage in large cities:

1. is processed by aerobic and then anaerobic bacteria in the secondary treatment in Sewage Treatment Plant (STPs)
2. when treated in STPs, does not really require the aeration step as the sewage contains adequate oxygen
3. has very high amounts of suspended solids and dissolved salts
4. has a high BOD as it contains both aerobic and anaerobic bacteria

## CHEMISTRY - SECTION A

**101** The process that is not related to the purification of colloidal solutions is:

1. Dialysis
2. Ultrafiltration
3. Tyndall effect
4. Electro-dialysis

**102** Identify the order of reaction and the unit of rate constant for the following rate expression:

$$\text{Rate} = K[A]^{3/2}[B]^{-1}$$

1.  $\frac{3}{4}$  &  $L^{-3/2} \text{ mol}^{3/2} \text{ s}^{-1}$
2.  $-1$  &  $L \text{ mol}^{-1} \text{ s}^{-1}$
3.  $2$  &  $L^{-2} \text{ mol}^2 \text{ s}^{-1}$
4.  $\frac{1}{2}$  &  $L^{-1/2} \text{ mol}^{1/2} \text{ s}^{-1}$

**103** Which statements among the following is not correct?

1.	When conduction band and valence band overlap, a semiconductor is obtained
2.	Ferrimagnetism arises due to the alignment of magnetic moments of the domains in the substance in parallel and anti-parallel directions in unequal numbers
3.	Replacing some silicon atoms by boron atoms in crystal of silicon produces p-type semiconductor
4.	Replacing some germanium atoms by phosphorus atoms in a crystal of germanium produces n-type semiconductor

**104** Which of the following is the correct order for the flocculation power of negative and positive sols, respectively?

1.  $[\text{Fe}(\text{CN})_6]^{4-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$  and  $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$
2.  $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$  and  $[\text{Fe}(\text{CN})_6]^{4-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$
3.  $[\text{Fe}(\text{CN})_6]^{4-} < \text{PO}_4^{3-} < \text{SO}_4^{2-} < \text{Cl}^-$  and  $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^+$
4.  $\text{Al}^{3+} < \text{Ba}^{2+} < \text{Na}^+$  and  $[\text{Fe}(\text{CN})_6]^{4-} < \text{PO}_4^{3-} < \text{SO}_4^{2-} < \text{Cl}^-$

**105**  $\text{Zn}(s) + \text{Cu}^{2+}(0.1\text{M}) \rightarrow \text{Zn}^{2+}(1\text{M}) + \text{Cu}(s)$

For the redox reaction taking place in a cell,  $E_{\text{cell}}^o$  is 1.10 volt.  $E_{\text{cell}}$  for the cell will be-

$$\left(2.303 \frac{RT}{F} = 0.0591\right)$$

1. 2.14 V
2. 1.80 V
3. 1.07 V
4. 0.82 V

**106** The non-stoichiometric compound  $\text{Cu}_{1.8}\text{S}$  is prepared by the incorporation of  $\text{Cu}^{2+}$  ion in the lattice of Cuprous sulphide. The percentage of  $\text{Cu}^{2+}$  ions in the total content of the compound is:

1. 88.88
2. 11.11
3. 89.8
4. 99.8

**107** Which of the following is not a disproportionation reaction?

1.  $\text{H}_2\text{S}_2\text{O}_8 \rightarrow \text{H}_2\text{SO}_4 + \text{O}_2$
2.  $\text{P}_4 \xrightarrow{\text{H}_2\text{O}} \text{PH}_3 + \text{H}_3\text{PO}_4$
3.  $\text{H}_2\text{SO}_5 \rightarrow \text{H}_2\text{SO}_4 + \frac{1}{2}\text{O}_2$
4.  $\text{S}_8 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{S} + \frac{1}{2}\text{O}_2$

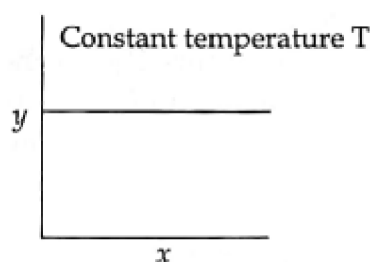
**108** Which of the following information is incorrect regarding Tyndall effect?

1. The diameter of dispersed particles is much smaller than the wavelength of light used
2. In lyophobic colloids, difference in refractive indices of DP and DM is appreciable therefore, Tyndall effect is quite well defined
3. Light thrown from a projector in the cinema hall is an example of Tyndall effect
4. It is used to differentiate colloidal solutions from a true solution

**109** Consider benzoic acid associates in benzene and gets dimerized. If benzoic acid associates up to 70%, then the value of van't Hoff factor (i) will be:

1. 0.70
2. 0.65
3. 0.46
4. 0.78

**110** The given graph is a representation of the kinetics of a reaction.



The y and x axes for zero and first-order reactions, respectively are

1.	zero order (y=rate and x=concentration), first order (y=rate and x= $t_{1/2}$ )
2.	zero order (y=concentration and x=time), first order (y= $t_{1/2}$ and x = concentration)
3.	zero order (y=concentration and x= time), first order (y=rate constant and x= concentration)
4.	zero order (y=rate and x=concentration), first order (y= $t_{1/2}$ and x = concentration)

**111** Which one of the following statements about a mercury cell is incorrect?

1. Zinc- Hg amalgam acts as anode
2. Paste of HgO and C acts as cathode
3. Paste of KOH and ZnO is used as electrolyte
4. Cell potential is 2.50V and it keeps on decreasing with the life of the cell

**112** Which of the following reactions is a decomposition redox reaction?

1.  $2\text{Pb}(\text{NO}_3)_2(\text{s}) \rightarrow 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
2.  $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{NO}(\text{g})$
3.  $\text{Cl}_2(\text{g}) + 2\text{OH}^-(\text{aq}) \rightarrow \text{ClO}^-(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$
4.  $\text{P}_4(\text{s}) + 3\text{OH}^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) \rightarrow \text{PH}_3(\text{g}) + 3\text{H}_2\text{PO}_2^-(\text{aq})$

**113** Among the following, a distinct feature of physisorption is:

1. It is caused by chemical bond formation.
2. It is highly specific in nature.
3. It is irreversible.
4. None of the above.

**114** The boiling point of 0.001 M aqueous solutions of NaCl,  $\text{Na}_2\text{SO}_4$ ,  $\text{K}_3\text{PO}_4$  and  $\text{CH}_3\text{COOH}$  should follow the order-

1.  $\text{CH}_3\text{COOH} < \text{NaCl} < \text{Na}_2\text{SO}_4 < \text{K}_3\text{PO}_4$
2.  $\text{NaCl} < \text{Na}_2\text{SO}_4 < \text{K}_3\text{PO}_4 < \text{CH}_3\text{COOH}$
3.  $\text{CH}_3\text{COOH} < \text{K}_3\text{PO}_4 < \text{Na}_2\text{SO}_4 < \text{NaCl}$
4.  $\text{CH}_3\text{COOH} < \text{K}_3\text{PO}_4 < \text{NaCl} < \text{Na}_2\text{SO}_4$

**115** An aqueous solution contains 37.92%  $\text{Na}_2\text{S}_2\text{O}_3$  by weight. In this solution, the mole fraction of  $\text{Na}_2\text{S}_2\text{O}_3$  is:

(Total weight of solution = 1250 g)

1. 0.051
2. 0.510
3. 0.065
4. 0.65

**116** A compound is formed by two elements M and N. Element N forms a hexagonal closed pack array with  $\frac{2}{3}$  of the octahedral holes occupied by M. The formula of the compound is:

1.  $\text{M}_4\text{N}_3$
2.  $\text{M}_2\text{N}_3$
3.  $\text{M}_3\text{N}_2$
4.  $\text{M}_3\text{N}_4$

**117** The strongest reducing agent on the basis of  $E^\circ$  values is:

1.  $\text{A}^+/\text{A} ; E^\circ = -3.04\text{V}$
2.  $\text{B}^+/\text{B} ; E^\circ = -2.71\text{V}$
3.  $\text{C}^+/\text{C} ; E^\circ = -2.92\text{V}$
4.  $\text{D}^+/\text{D} ; E^\circ = +0.79\text{V}$

**118** Which of the following statements is not correct regarding galvanic cells?

1. Oxidation occurs at the anode.
2. Ions carry current inside the cell.
3. Electrons flow in the external circuit from cathode to anode.
4. When the cell potential is positive, the cell reaction is spontaneous.

**119** The relative lowering of vapour pressure produced by dissolving 7.5 g of a substance in 1000 g of water is 0.00588. The molecular weight in g/mol of the substance will be :

1. 18
2. 23
3. 34
4. 60

**120** The reduction potential of hydrogen electrode in contact with a solution having pH = 8 is (Given :  $P_{\text{H}_2} = 1 \text{ atm}$ )

1. -0.71 V
2. -0.47 V
3. -0.95 V
4. -0.36 V

**121** Which of the following are non-polar molecular solids?

- A. Ar
- B. HCl
- C.  $\text{SO}_2$
- D. C (Diamond)
- E.  $\text{H}_2$

Choose the correct answer from the options given below:

1. A, B, C, and E only.
2. B, and C only.
3. B, C, and E only.
4. A and E only.

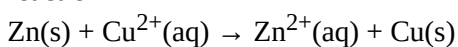
**122** Statement-I:  $AgF_2$  acts as a very strong oxidising agent if formed.

Statement-II: Carbon exhibits oxidation states from -4 to +4 in its compounds

In the light of above two statements, choose the correct option among the following

- Both statement-I and statement-II are correct
- Both statement-I and statement-II are incorrect
- Statement-I is correct but statement-II is incorrect
- Statement-I is incorrect but statement-II is correct

**123** Standard electrode potential for the cell with cell reaction



is 1.1 V. Calculate the standard Gibbs energy change for the cell reaction.

(Given  $F = 96487 \text{ C mol}^{-1}$ )

- 200.27 kJ mol<sup>-1</sup>
- 212.27 kJ mol<sup>-1</sup>
- 212.27 J mol<sup>-1</sup>
- 200.27 J mol<sup>-1</sup>

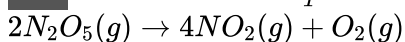
**124** The time for the half-life period of a certain reaction  $A \rightarrow \text{Products}$  is 1 hour. When the initial concentration of the reactant 'A' is 2.0 mol L<sup>-1</sup>, the time taken for its concentration to come from 0.50 to 0.25 mol L<sup>-1</sup>, if it is a zero-order reaction, is-

- 1h
- 4 h
- 0.5 h
- 0.25 h

**125** A mixture of phenol and aniline is an example of:

- Ideal solution.
- Non-ideal solution exhibiting positive deviation from Raoult's law.
- Non-ideal solution exhibiting negative deviation from Raoult's law.
- Minimum boiling azeotrope.

**126** The plot of  $\ln k$  vs  $\frac{1}{T}$  for the following reaction



gives a straight line with the slope of line equal to  $-1.0 \times 10^4 \text{ K}$ . Activation energy for the reaction in J mol<sup>-1</sup> is

(Given  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ )

- $4.0 \times 10^2$
- $4.0 \times 10^{-2}$
- $8.3 \times 10^{-4}$
- $8.3 \times 10^4$

**127** For the dissolution of a solid in a liquid, choose the incorrect statement:

- If the dissolution is endothermic, the solubility should increase with rise in temperature
- If the dissolution is exothermic, the solubility should decrease with rise in temperature
- Pressure affects the solubility of solids in liquids such that on increasing pressure, the solubility of solids in liquids increases
- Solute dissolves in a solvent if the intermolecular interactions are similar in the two

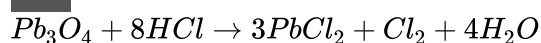
**128** Among the following compounds, an element that exhibits two oxidation states in the same compound is:

- NH<sub>2</sub>OH
- NH<sub>4</sub>NO<sub>3</sub>
- N<sub>2</sub>H<sub>4</sub>
- N<sub>3</sub>H

**129** One mole of sugar is dissolved in three moles of water at 298 K. The relative lowering of vapour pressure is

- 0.25
- 0.20
- 0.50
- 0.33

**130**



In the reaction given above, oxidant (O) and reductant (R) are respectively:

- O = PbO, R = Cl<sup>-</sup>
- O = PbO<sub>2</sub>, R = PbO
- O = PbO, R = PbO<sub>2</sub>
- O = PbO<sub>2</sub>, R = Cl<sup>-</sup>

**131** For a reaction with activation energy 210 kJ/mol at 300 K, the fraction of molecules having energy equal to or greater than the activation energy is:

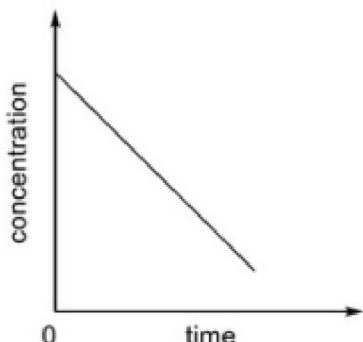
- $2.303 \log(-84.19)$
- $10^{-84.19}$
- $\exp(-84.19)$
- $\ln(-8526.18)$

**132** Electrolysis of an aqueous solution of NaCl results in

- increase in pH of the solution
- decrease in pH of the solution
- liberation of oxygen at the cathode
- liberation of hydrogen at the anode



- 133** The plot of concentration of a reactant vs. time for a chemical reaction is shown below:



The order of this reaction with respect to the reactant is

1. 0
2. 1
3. 2
4. not possible to determine from this plot

- 134** 2 grams of non-volatile solute dissolves in 200 grams each of two different solvents A and B to attain the same molality. If ratio of  $K_b$  of solvent A and B is 1:8 and the ratio of elevation in boiling points is x:y, then the value of y is-

1. 4
2. 6
3. 10
4. 8

- 135** Consider a reaction,  $A \rightarrow \text{Product}$  with  $k = 2.303 \times 10^{-2} \text{ s}^{-1}$ . The concentration of 'A' remaining after 100 s if the initial concentration of 'A' is  $1.0 \text{ mol L}^{-1}$  is:

1.  $0.10 \text{ mol L}^{-1}$
2.  $0.25 \text{ mol L}^{-1}$
3.  $0.01 \text{ mol L}^{-1}$
4.  $0.02 \text{ mol L}^{-1}$

## CHEMISTRY - SECTION B

- 136** The correct statement about chemisorption is:

1. The chemical bonds in chemisorption are always covalent in nature.
2. Chemisorption is also known as activated adsorption.
3. Chemisorption decreases with increase in temperature.
4. Chemisorption results in multi-molecular layers on an adsorbent surface under high pressure.

- 137** A mixture of toluene and benzene forms a nearly ideal solution. Assume  $P_B^\circ$  and  $P_T^\circ$  to be the vapor pressure of pure benzene and toluene, respectively. The slope of the line obtained by plotting the total vapor pressure to the mole fraction of benzene is:

1.  $P_B^\circ - P_T^\circ$
2.  $P_T^\circ - P_B^\circ$
3.  $P_B^\circ + P_T^\circ$
4.  $(P_B^\circ + P_T^\circ)/2$

- 138** Statement I: Order is applicable only for elementary reactions whereas molecularity is applicable for both elementary as well as complex reactions.

Statement II: Order of a reaction is an experimental quantity.

In the light of the above statements, identify the correct option:

1. Both statement I and statement II are correct
2. Both statement I and statement II are incorrect
3. Statement I is incorrect but statement II is correct
4. Statement I is correct but statement II is incorrect

- 139** Assertion(A): The oxidation state of Cr in  $\text{CrO}_5$  is +6.

Reason(R): All oxygen atoms have -2 oxidation number.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true and R is false.
4. A and R both are false.

- 140** For the reaction  $2A + 3B + \frac{3}{2}C \rightarrow 3P$ , the correct statement is-

1.  $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$
2.  $\frac{dn_A}{dt} = \frac{3}{2} \frac{dn_B}{dt} = \frac{3}{4} \frac{dn_C}{dt}$
3.  $\frac{dn_A}{dt} = \frac{dn_B}{dt} = \frac{dn_C}{dt}$
4.  $\frac{dn_A}{dt} = \frac{2}{3} \frac{dn_B}{dt} = \frac{4}{3} \frac{dn_C}{dt}$

**141** Match List I with List II

List I	List II
Types of Solutions	Common Examples
A. Gas in Gas	I. Solution of hydrogen in palladium
B. Solid in Gas	II. Mixture of oxygen and nitrogen gas
C. Gas in Liquid	III. Camphor in nitrogen gas
D. Gas in solid	IV. Oxygen dissolved in water

Choose the correct answer from the options given below:

1. A-II, B-III, C-IV, D-I
2. A-II, B-I, C-IV, D-III
3. A-II, B-IV, C-III, D-I
4. A-II, B-IV, C-I, D-III

**142** Shape-selective catalysis depends upon the:

1. Pore structure of the catalyst only.
2. Size of the reactant only.
3. Size of the product only.
4. Size of both reactant and product and pore structure of the catalyst.

**143**  $\wedge_m^\circ$  for NaCl, HCl and  $CH_3COONa$  are 126.4, 425.9, and  $91.05 \text{ S cm}^2 \text{ mol}^{-1}$  respectively. If the conductivity of  $0.001028 \text{ mol L}^{-1}$  acetic acid solution is  $4.95 \times 10^{-5} \text{ S cm}^{-1}$ , the degree of dissociation of the acetic acid solution is-

1. 0.01233
2. 1.00
3. 0.1233
4. 1.233

**144** The cell constant of a conductivity cell having resistance and conductivity of  $100 \Omega$  and  $1.29 \text{ S/cm}$ , respectively is:

1.  $1.29 \text{ cm}^{-1}$
2.  $12.9 \text{ cm}^{-1}$
3.  $129 \text{ cm}^{-1}$
4.  $1290 \text{ cm}^{-1}$

**145** Assume that the oxidation numbers are as shown below:

$N = -3, H = +1, Cr = +6, O = -2$

Which compound formula given below is correct?

1.  $[(NH_4)_2CrO_4]^+$
2.  $NH_4Cr_2O_7$
3.  $(NH_4)_2CrO_4$
4.  $[(NH_4)_3CrO_4]^-$

**146** The elementary step of the reaction,  $2Na + Cl_2 = 2NaCl$  is found to follow 3<sup>rd</sup> order kinetics. Its molecularity is:

1. 1
2. 2
3. 3
4. 4

**147** Given a general reaction,  $A + 2B \rightarrow C + D$

The correct statement among the following is:

1. Rate of disappearance of A = Rate of disappearance of B.
2. Rate of disappearance of A =  $1/2$  Rate of appearance of C.
3. Rate of disappearance of A =  $1/2$  Rate of disappearance of B.
4. Rate of disappearance of A =  $1/2$  Rate of appearance of D.

**148** Sucrose,  $C_{12}H_{22}O_{11}$ , is added to water at  $20^\circ\text{C}$  until no more sucrose will dissolve. Following four statements are constructed about sucrose and the solution that is produced:

- (A) A saturated solution of sucrose is produced.
- (B) The freezing point of the solution is  $0^\circ\text{C}$ .
- (C) Sucrose is a non-polar substance.
- (D) Sucrose is the solute.

Which two statements, from the four given above, are correct?

1. A and B only.
2. C and A only.
3. C and D only.
4. A and D only.

**149** A metal X forms body-centered cubic crystals. If the edge length of its unit cell is  $350 \text{ pm}$ , the atomic radius is:

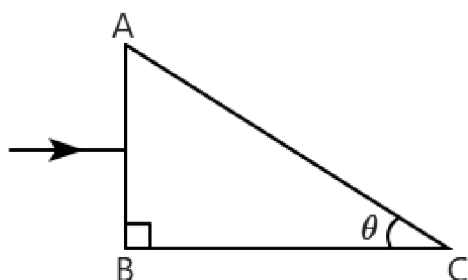
1.  $140.5 \text{ pm}$
2.  $151.4 \text{ pm}$
3.  $139.5 \text{ pm}$
4.  $160.5 \text{ pm}$

**150** Incorrect statement among the following is:

1. The appearance of color in solid alkali metal halides is generally due to F-centre
2. The number of Bravais lattices in which crystals can be categorized is 14
3. Schottky defects have no effect on the density of crystalline solids
4. Quartz is a piezo electric crystal

### PHYSICS - SECTION A

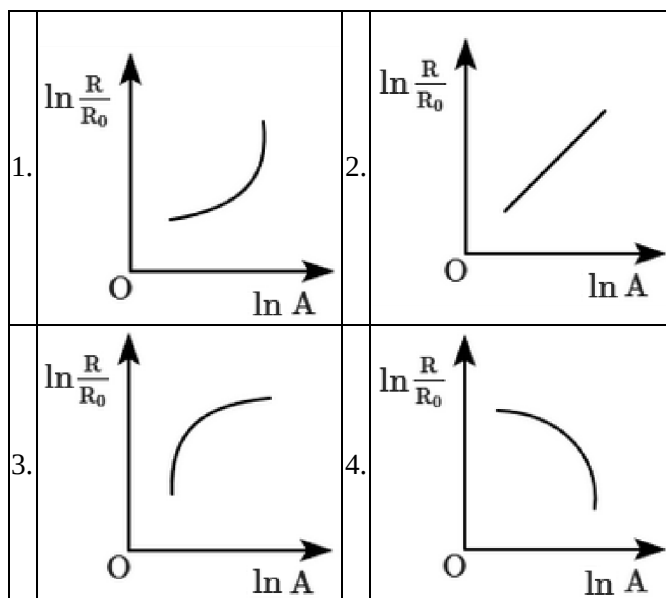
**151** In the figure, a ray of light is perpendicular to face AB of a glass prism ( $\mu = 3/2$ ). If prism is immersed in water ( $\mu = 4/3$ ), what will be the maximum value of  $\theta$  so that ray suffers total internal reflection at face AC? (Take  $\sin^{-1}(8/9) = 63^\circ$ )



1.  $15^\circ$
2.  $27^\circ$
3.  $37^\circ$
4.  $45^\circ$

**152** Which of the following figure represents the variation of  $\ln\left(\frac{R}{R_0}\right)$  with  $\ln A$ ?

(Where  $R$  = radius of a nucleus and  $A$  = its mass number)



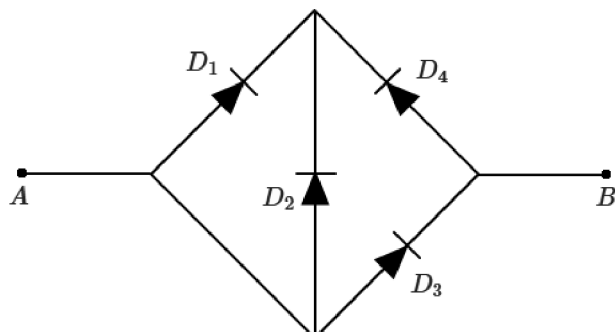
**153** The work functions of two metals are 2.75 eV and 2 eV respectively. If these are irradiated by photons of energy 3 eV, the ratio of maximum momenta of the photoelectrons emitted respectively by them is:

1. 1 : 2
2. 1 : 3
3. 1 : 4
4. 2 : 1

**154** The transition from the state  $n = 4$  to  $n = 3$  in hydrogen-like atoms results in ultraviolet radiation. Infrared radiation will be obtained in the transition:

1.  $2 \rightarrow 1$
2.  $3 \rightarrow 2$
3.  $4 \rightarrow 2$
4.  $5 \rightarrow 4$

**155** In the circuit shown in the figure,  $V_A > V_B$ . Which of the diodes conduct?



1. only  $D_3$
2.  $D_1$  and  $D_3$
3. all of the diodes
4. none of the diodes

**156** The critical angle of a certain medium is  $\sin^{-1}(3/5)$ . The polarising angle of the medium is:

1.  $\sin^{-1}(4/5)$
2.  $\tan^{-1}(5/3)$
3.  $\tan^{-1}(3/4)$
4.  $\tan^{-1}(4/3)$

**157** The intensities of light coming from two different slits are in the ratio 1 : 4 in Young's double-slit experiment. The ratio of intensities corresponding to the maxima and minima in the interference pattern would be:

1.  $\sqrt{2} : 1$
2. 2 : 1
3. 4 : 1
4. 9 : 1

**158** For a compound microscope, magnification is 480 when final image is formed at A far point. If linear magnification due to objective is 20, then what will angular magnification due to eyepiece when final image is formed at the near point? (Object is fixed)

1. 24
2. 25
3. 500
4. 504

**159** Consider an electron revolving around nucleus in an orbit.  $K.E$  denotes its kinetic energy,  $P.E$  denotes potential energy of electron-nucleus system and  $T.E$  denotes total energy of electron-nucleus system. The value of  $\left| \frac{K.E + T.E}{P.E} \right|$  is equal to:

1. 0
2. 1
3. 2
4. 3

**160** What will happen when the light suffers refraction while it travels from a rarer to a denser medium?

1.	Its wavelength increases but frequency remains constant.
2.	Its wavelength decreases but frequency remains constant.
3.	Its wavelength remains constant but frequency decreases.
4.	Its wavelength and frequency both decrease.

**161** Tritium undergoing  $\beta$ -decay has a half-life of 12.5 years. The percentage of pure tritium which remains undecayed after 50 years is:

1. 93.75
2. 87.5
3. 6.25
4. 3.125

**162** Given below are two statements:

<b>Assertion (A):</b>	Danger signals are made of red colour.
<b>Reason (R):</b>	Velocity of red light in air is maximum and thus has more visibility in the dark.

1.	Both (A) and (R) are true and (R) is the correct explanation of (A).
2.	Both (A) and (R) are true but (R) is not the correct explanation of (A).
3.	(A) is true but (R) is false.
4.	Both (A) and (R) are false.

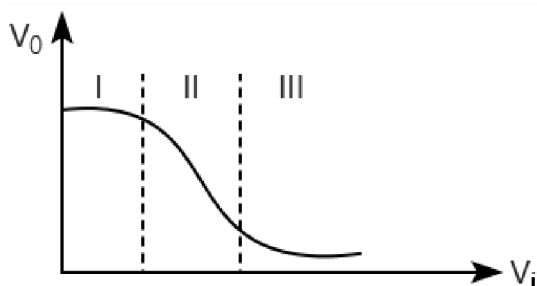
**163** In Young's double-slit experiment, slits are separated by 0.5 mm and the screen is placed 150 cm away. A beam of light consisting of two wavelengths, 650 nm and 975 nm is used to obtain interference fringes on the screen. The least distance from the common central maximum to the point where the bright fringes due to both wavelengths coincide is:

1. 5.85 mm
2. 7.8 mm
3. 4.2 mm
4. 3.6 mm

**164** In the case of the photoelectric effect,:

1.	since photons are absorbed as a single unit, there is no significant time delay in the emission of photoelectrons.
2.	Einstein's analysis gives a critical frequency $\nu_0 = \frac{e\phi}{h}$ , where $\phi$ is the work function and the light of this frequency ejects electrons with maximum kinetic energy.
3.	only a small fraction of the incident photons succeed in ejecting photoelectrons while most of them are absorbed by the system as a whole and generate thermal energy.
4.	the maximum kinetic energy of the electrons is dependent on the intensity of radiation.

**165** The transfer characteristics of a common emitter (CE) amplifier is shown in the figure. The transistor works as a switch in the region:

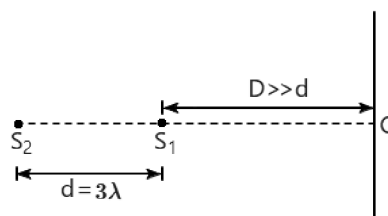


1. (I)
2. (II)
3. (III)
4. Both (I) and (III)

**166** Potential barrier across a p-n junction is 0.6 V. Electric field intensity, in the depletion region having a width of  $6 \times 10^{-6}$  m, will be:

1.  $1 \times 10^5$  N/C
2.  $2 \times 10^5$  N/C
3.  $3 \times 10^5$  N/C
4.  $4 \times 10^5$  N/C

**167** In the given figure  $S_1$  and  $S_2$  are two coherent sources oscillating in phase. The total number of bright fringes and their shape as seen on the large screen will be:



1. 3, rectangular strips
2. 3, circular
3. 4, rectangular strips
4. 4, circular

**168** An object is at the centre of the curvature of a concave mirror having radius of curvature  $R$ . If object is displacement by  $\frac{R}{2}$  away from the mirror, the displacement of the image will be:

1.  $\frac{5R}{8}$  towards the mirror
2.  $\frac{5R}{8}$  away from the mirror
3.  $\frac{R}{4}$  towards the mirror
4.  $\frac{R}{4}$  away from mirror

**169**  ${}_{92}^{238}\text{U}$  converts into  ${}_{82}^{206}\text{Pb}$  by radio active decay process. How many  $\alpha$ -particle and  $\beta$ -particle may be emitted in the process?

1.  $8\alpha$  and  $8\beta$
2.  $5\alpha$  and  $12\beta$
3.  $8\alpha$  and  $6\beta$
4.  $6\alpha$  and  $8\beta$

**170** Power of an equi-convex lens is  $P$ . After cutting it in different ways, the combination of lenses is given in Column-I and their effective power is given in Column-II. Match the following two columns.

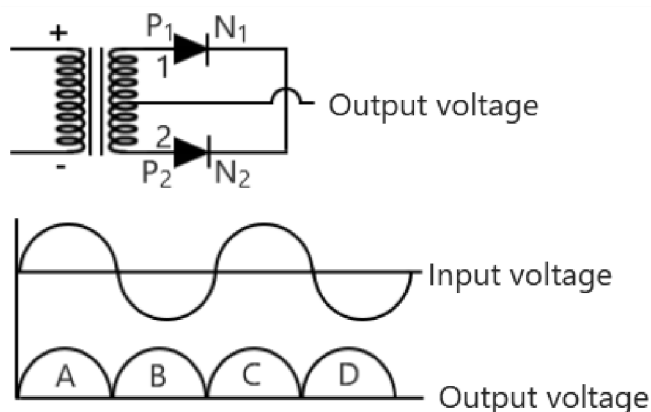
	Column-I		Column-II
A.		P.	zero
B.		Q.	$P$
C.		R.	$2P$
D.		S.	$\frac{P}{2}$

1.	A $\rightarrow$ Q, B $\rightarrow$ P, C $\rightarrow$ S, D $\rightarrow$ R
2.	A $\rightarrow$ S, B $\rightarrow$ R, C $\rightarrow$ Q, D $\rightarrow$ P
3.	A $\rightarrow$ Q, B $\rightarrow$ S, C $\rightarrow$ Q, D $\rightarrow$ R
4.	A $\rightarrow$ S, B $\rightarrow$ R, C $\rightarrow$ Q, D $\rightarrow$ Q

**171** A telescope has an objective lens of 10 cm diameter and is situated at a distance of 1 km from two objects. The minimum distance between these two objects, which can be resolved by the telescope, when the mean wavelength of light is 5000 Å, is of the order of:

1. 5 m
2. 0.5 m
3. 5 mm
4. 5 cm

**172** A full wave rectifier circuit along with the input and output voltages is shown in the figure. The contribution to the output voltage from diode-2 is:



1. A, C
2. B, D
3. B, C
4. A, D

**173** Let  $K_1$  and  $K_2$  be the maximum kinetic energies of photo-electrons emitted when two monochromatic beams of wavelength  $\lambda_1$  and  $\lambda_2$ , respectively, are incident on a metallic surface. If  $\lambda = 3\lambda_2$  then:

1.  $K_1 > \frac{K_2}{3}$
2.  $K_1 < \frac{K_2}{3}$
3.  $K_1 = \frac{K_2}{3}$
4.  $K_2 = \frac{K_1}{3}$

**174** In a photoelectric experiment, if the intensity ( $\text{W/m}^2$ ) of incident light is doubled while keeping the frequency the same, then the saturation current:

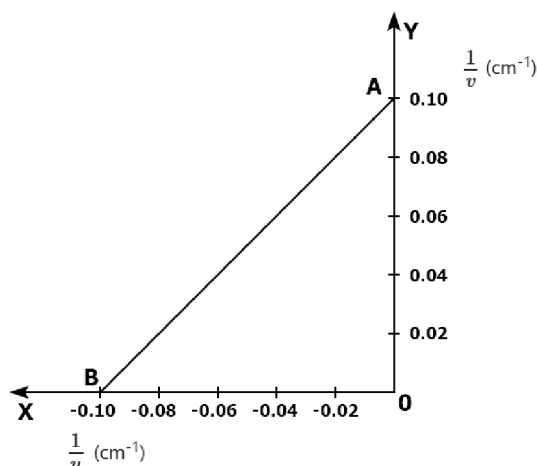
1. remains constant
2. also doubles
3. halves
4. becomes four times

**175** Which of the following is not exhibited by X-rays?

1. photoelectric effect
2. polarisation
3. interference
4. deflection in an electric field



**176** The graph between  $\frac{1}{u}$  and  $\frac{1}{v}$  for a thin convex lens in order to determine its focal length is plotted as shown in the figure. The refractive index of the lens is 1.5 and both surfaces have the same radius of curvature  $R$ . The value of  $R$  will be:  
(where  $u$  = object distance,  $v$  = image distance)



1. 10 cm
2. 20 cm
3. 30 cm
4. 40 cm

**177** Photons and electrons of the same wavelength are compared. Which one carries larger momentum?

1.	photon
2.	electron
3.	neither, since both have equal momenta
4.	it could be either, depending on the energy

**178** Instead of angular momentum quantization, a student posits that energy is quantized as  $E = -\frac{E_0}{n}$  ( $E_0 > 0$ ) and  $n$  is a positive integer. Which of the following options is correct?

1.	the radius of the electron orbit is $r \propto \sqrt{n}$ .
2.	the speed of the electron is $v \propto \sqrt{n}$ .
3.	the angular speed of the electron is $\omega \propto 1/n$ .
4.	the angular momentum of the electron is $\propto \sqrt{n}$ .

**179** Regarding the size of the emitter region, the base region and the collector region of a transistor, which of the following statement is true?

1.	emitter = collector > base
2.	emitter > collector > base
3.	collector > emitter = base
4.	collector > emitter > base

**180** The magnifying power of an astronomical telescope is 8 and the distance between the two lenses is 54 cm. The focal lengths of the eye lens and objective lens will be respectively:

1. 6 cm and 48 cm
2. 48 cm and 6 cm
3. 8 cm and 64 cm
4. 64 cm and 8 cm

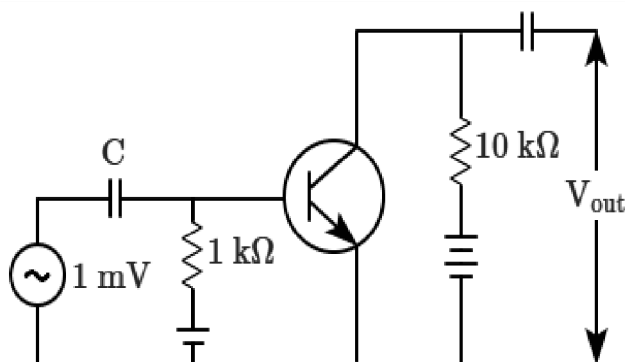
**181** Which one of the following statements is true for Young's double-slit experiment?

1.	fringe width is proportional to wavelength $\lambda$ .
2.	fringe width is proportional to slit width $d$ .
3.	fringe width is inversely proportional to screen distance $D$ .
4.	fringe width is proportional to the position of fringe from the central maximum.

**182** What will be the input of  $A$  and  $B$  for the Boolean expression  $\overline{A + B} + \overline{A \cdot B} = 0$ ?

1. 0, 0
2. 0, 1
3. 1, 0
4. 1, 1

**183** An n-p-n transistor with current gain  $\beta = 100$  in a common emitter configuration is shown in the figure. The output voltage of the amplifier will be:

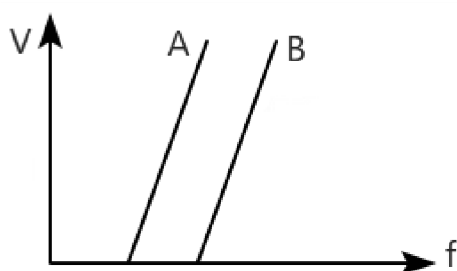


1. 0.1 V
2. 1.0 V
3. 10 V
4. 100 V

**184** In a nuclear reactor, the function of the moderator is:

1.	to absorb neutrons.
2.	to keep the reactor from going critical.
3.	to slow down the neutrons.
4.	to absorb heat from the core.

**185** The stopping potential ( $V$ ) versus frequency ( $f$ ) of incident radiation is plotted for two photoelectric surfaces A and B. We can say that work function of A



1.	is equal to that of B
2.	is greater than that of B
3.	is smaller than that of B
4.	cannot be related to that of B from the graph

## PHYSICS - SECTION B

**186** In a reaction, 2 amu mass is converted into energy. Using Einstein's mass-energy relationship, the amount of energy released is:

1. 1863 J
2. 931.5 MeV
3. 1863 MeV
4. 931.5 J

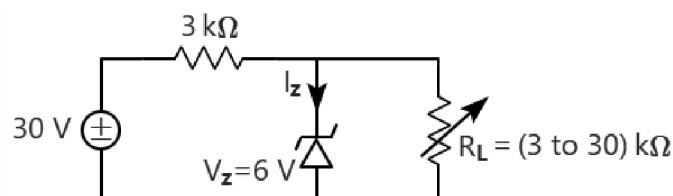
**187** Specify which of the following type of material might satisfy these descriptions: A half-filled valence band, an empty conduction band, and an energy gap of 1 eV.

1. conductor
2. insulator
3. semiconductor
4. none of the above

**188** White light is split into a spectrum by a prism and it is seen on a screen. If we put another identical inverted prism behind it in contact, what will be seen on the screen?

1.	violet will appear where red was.
2.	the spectrum will remain the same.
3.	there will be no spectrum, but only the original light with no deviation.
4.	there will be no spectrum, but the original light with deviation.

**189** Using the ideal Zener diode approximations, the range of current through the diode as shown in the figure, is:



1.  $2 \text{ mA} \leq I_z \leq 6 \text{ mA}$
2.  $6 \text{ mA} \leq I_z \leq 7.8 \text{ mA}$
3.  $2 \text{ mA} \leq I_z \leq 6.8 \text{ mA}$
4.  $2 \text{ mA} \leq I_z \leq 8 \text{ mA}$

190 Given below are two statements:

<b>Statement I:</b>	In total internal reflection, the angle of incidence must be greater than a certain minimum angle which depends on the media involved.
<b>Statement II:</b>	Total internal reflection cannot occur when light is travelling from an optically rarer to a denser medium.

- Statement I is incorrect and statement II is correct.
- Both statement I and statement II are correct.
- Both statement I and statement II are incorrect.
- Statement I is correct and statement II is incorrect.

191 For a common emitter (CE) transistor amplifier, the collector voltage is 8 V. The voltage drop across a  $800\ \Omega$  resistor in the collector circuit is 0.5 V. The base current is: (Take  $\beta = 24$ )

- 26 mA
- 62.5 mA
- 26  $\mu A$
- 62.5  $\mu A$

192 A near-sighted person cannot see distinct objects beyond 80 cm from the eye. What is the power in diopters of the spectacle lenses which will enable him to see distant objects clearly?

- 2
- 1.5
- 1.25
- 1

193 Suitable impurities are added to a semiconductor depending on its use. This is to:

- increase its electrical resistivity
- increase its electrical conductivity
- increase its life
- enable it to tolerate higher voltage

194 The dynamic resistance of a diode is given by  $R = \frac{26}{i(mA)}\ \Omega$ , where  $i$  is the diode current.

<b>Statement I:</b>	If the current through the diode increases, then the dynamic resistance decreases.
<b>Statement II:</b>	If the temperature of the diode is increased, with the potential difference fixed, the dynamic resistance decreases.

- Statement I is incorrect and statement II is correct.
- Both statement I and statement II are correct.
- Both statement I and statement II are incorrect.
- Statement I is correct and statement II is incorrect.

195 The half-life of radon is 3.8 days. After how many days will only one-twentieth of radon sample be left over? ( $\ln 20 \approx 3$ )

- 5.5
- 9.3
- 16.5
- 28.3

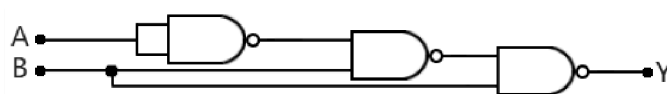
196 The ratio of wavelengths of proton and deuteron accelerated by potential  $V_p$  and  $V_d$  is  $1 : \sqrt{2}$ . Then, the ratio of  $V_p$  to  $V_d$  will be:

- 1 : 1
- $\sqrt{2} : 1$
- 2 : 1
- 4 : 1

197 A ray of light is incident on a mirror which is lying on the  $x - y$  plane. The reflected ray travels along the direction of the vector  $3\hat{i} - 4\hat{j} + 2\hat{k}$ . The incident ray must be along:

- $-3\hat{i} + 4\hat{j} + 2\hat{k}$
- $3\hat{i} - 4\hat{j} - 2\hat{k}$
- $-3\hat{i} - 4\hat{j} + 2\hat{k}$
- $-3\hat{i} + 4\hat{j} - 2\hat{k}$

198 The arrangement of NAND gates shown below effectively works as:



- AND gate
- OR gate
- NAND gate
- NOR gate

**199** Given below are two statements:

<b>Assertion (A):</b>	The phenomenon of X-ray production is basically inverse of photoelectric effect.
<b>Reason (R):</b>	X-rays are electromagnetic waves.

1.	Both <b>(A)</b> and <b>(R)</b> are true and <b>(R)</b> is the correct explanation of <b>(A)</b> .
2.	Both <b>(A)</b> and <b>(R)</b> are true but <b>(R)</b> is not the correct explanation of <b>(A)</b> .
3.	<b>(A)</b> is true but <b>(R)</b> is false.
4.	Both <b>(A)</b> and <b>(R)</b> are false.

**200** A parallel beam of light of wavelength 600 nm falls normally on a slit of width  $a$ . What should the value of  $a$  so that the first-order diffraction minimum occurs at an angle of  $30^\circ$ ?

1.  $1.1 \times 10^{-6}$  m
2.  $1.2 \times 10^{-6}$  m
3.  $1.3 \times 10^{-6}$  m
4.  $1.4 \times 10^{-6}$  m

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