

IMPORTANT INSTRUCTIONS

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side – 2 carefully with blue/black ball point pen only.
2. The test of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.
3. Use Blue/Black Ball Point Pen only for writing particulars on this page/marking responses.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must hand over the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
6. The CODE for this Booklet is Q. Make sure that the CODE printed on Side – 2 of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Roll No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
8. Use of white fluid for correction is NOT permissible on the Answer Sheet.
9. Each candidate must show on demand his/her Admit Card to the Invigilator.
10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.
11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.
12. Use of Electronic/Manual Calculator is prohibited.
13. The candidates are governed by all Rules and Regulations of the examination with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of this examination.
14. No part of the Test Booklet and Answer Sheet shall be detached under and circumstances.
15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capital letters) : _____

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in wind current. They often possess well-exposed stamen (so that the pollens are easily dispersed into wind current and large often feathery stigma to easily trap air-borne pollen grains).

6. Which one of the following statements is not valid for aerosols?

- (1) They alter rainfall and monsoon patterns (2) They cause increased agricultural productivity
(3) They have negative impact on agricultural land (4) They are harmful to human health

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	They cause increased agricultural productivity	Easy	Ecology

Sol. Aerosols are harmful environmental pollutions which have adverse effect on agriculture.

7. Which among the following are the smallest living cells, known without a definite cell wall, pathogenic to plants as well as animals and can survive without oxygen?

- (1) *Pseudomonas* (2) *Mycoplasma* (3) *Nostoc* (4) *Bacillus*

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Mycoplasma	Easy	Diversity In The Living World

Sol. The *Mycoplasma* are organisms that completely lack a cell wall. They are the smallest living cells known and can survive without oxygen. Many *mycoplasma* are pathogenic in animals & plants.

8. In *Bougainvillea* thorns are the modifications of _____.

- (1) Adventitious root (2) Stem (3) Leaf (4) Stipules

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Stem	Easy	Structural Organisation In Plants And Animals

Sol. In *Bougainvillea* stem is modified into thorns. These thorns protect plants from browsing animals.

9. DNA replication in bacteria occurs

- (1) within nucleolus. (2) prior to fission.
(3) just before transcription. (4) during S phase.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	prior to fission.	Hard	Cell : Structure And Functions

Sol. The process of fission in bacteria involves the following steps:

- 1) First, the cell's DNA is replicated.
- 2) The replicated DNA copies then moves to opposite poles of the cells in an energy-dependent process.
- 3) The cell lengthens.
- 4) Then, the equatorial plate of the cell constricts and separates the plasma membrane such that each new cell has exactly the same genetic material.

10. Functional megaspore in an angiosperm develops into _____.

- (1) endosperm (2) embryo sac (3) embryo (4) ovule

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	embryo sac	Medium	Reproduction

Sol. In the following plants (Angiosperm), one of the megaspores is functional while the other three degenerate. Only functional megaspore develops into the female gametophyte (embryo sac).

11. Anaphase Promoting Complex (APC) is a protein degradation machinery necessary for proper mitosis of animal cells, if APC is defective in a human cell, which of the following is expected to occur?

- (1) Chromosomes will be fragmented (2) Chromosomes will not segregate
(3) Recombination of chromosome arms will occur (4) Chromosomes will not condense

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Chromosomes will not segregate	Medium	Cell : Structure And Functions

Sol. In mitosis, during anaphase the centromere divide and the chromatid start moving towards the two opposite poles. So if anaphase promoting complex (APC) is defective in a human cell, than chromosome segregation will not take place.

12. Which of the following is made up of dead cells?

- (1) Collenchyma (2) Phellem
(3) Phloem (4) Xylem parenchyma

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Phellem	Medium	Structural Organisation In Plants And Animals

Sol. Phellem is also called cork and forms outer layer in plants. The cells of phellem are dead at maturity because they lose protoplasm and becomes specialized to perform the function of protection in plants.

13. What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis?

- (1) The smaller the fragment size, the farther it moves
(2) Positively charged fragments move to farther end
(3) Negatively charged fragments do not moves
(4) The larger the fragment size, the farther it moves

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	The smaller the fragment size, the farther it moves	Medium	Biotechnology

Sol. Fragments of DNA can be separated by a technique known as gel electrophoresis. These DNA fragments separate according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.

14. Identify the wrong statement in context of heartwood

- (1) it is highly durable.
(2) it conducts water and minerals efficiently.
(3) it comprises dead elements with highly lignified walls.
(4) organic compounds are deposited in it.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	it conducts water and minerals efficiently.	Medium	Structural Organisation In Plants And Animals

Sol. Heartwood shows deposition of tannins, resins and aromatic substance. This region comprises dead elements and provides mechanical support. These substance make it hard durable and resistant to the attack of microorganism and insect. Heartwood does not conduct water and minerals.

15. An example of colonial alga is _____.

- (1) *Volvox* (2) *Ulothrix* (3) *Spirogyra* (4) *Chlorella*

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	<i>Volvox</i>	Easy	Diversity In The Living World

Sol. The form and size of algae is highly variable. The size ranges from the microscopic unit cellular forms like *Chlamydomonas*, to colonial forms like *Volvox* and to the filamentous form like *Ulothrix* and *Spirogyra*.

16. Zygotic meiosis is characteristic of _____.

- (1) *Fucus* (2) *Funaria* (3) *Chlamydomonas* (4) *Marchantia*

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	<i>Chlamydomonas</i>	Medium	Diversity In The Living World

Sol. Sporophytic generation is represented only by the one celled zygote in haplontic life cycle. The remaining phase of the life cycle exists as haploid phase. Zygotic raises is characteristic of *Chlamydomonas*

17. Which one of the following statements is correct, with reference to enzymes?

- (1) Diversity In The Living World (2) Coenzyme = Apoenzyme + Holoenzyme
 (3) Holoenzyme = Coenzyme + Co-factor (4) Apoenzyme = Holoenzyme + Coenzyme

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Diversity In The Living World	Easy	Cell : Structure And Functions

Sol. A conjugate enzyme i.e. holoenzyme consists of a protein part known as an apoenzyme and non protein co-factor known as coenzyme.

18. A disease caused by an autosomal primary non-disjunction is _____.

- (1) Klinefelter's Syndrome (2) Turner's Syndrome
 (3) Sickle Cell Anemia (4) Down's Syndrome

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Down's Syndrome	Medium	Genetics And Evolution

Sol. A disease caused by an autosomal primary non-disjunction is Down's syndrome - Trisomy.

Klinefelter's syndrome - 47, XXY

Turner's syndrome - 45, XO

Sickle cell anemia - due to point mutation - at the 6th place of globin chain where glutamic acid is replaced by valine.

19. A gene whose expression helps to identify transformed cell is known as _____.

- (1) vector (2) plasmid
 (3) structural gene (4) selectable marker

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	selectable marker	Easy	Biotechnology

Sol. Selectable markers helps in identifying and eliminating non transformants selectively permitting the growth of transformants.

20. Plants which produce characteristic pneumatophores and show vivipary belong to _____.

- (1) Halophytes (2) Psammophytes (3) Hydrophytes (4) Mesophytes

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Halophytes	Medium	Structural Organisation In Plants And Animals

Sol. Presence of pneumatophores and viviparity is an adaption of plants growing in saline, water logged conditions (Halophytes).

21. With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct?

- (1) Increasing atmospheric CO_2 concentration up to 0.05% can enhance CO_2 fixation rate
 (2) C_3 plants respond to higher temperatures with enhanced photosynthesis while C_4 plants have much lower temperature optimum
 (3) Tomato is a greenhouse crop which can be grown in CO_2 - enriched atmosphere for higher yield
 (4) Light saturation for CO_2 fixation occurs at 10% of full sunlight

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	C_3 plants respond to higher temperatures with enhanced photosynthesis while C_4 plants have much lower temperature optimum	Medium	Plant Physiology

Sol. With reference to factors affecting the rate of photosynthesis the C_4 plants respond to higher temperatures and show higher rate of photosynthesis, while C_3 plants have a much lower temperature optimum.

22. Select the correct route for the passage of sperms in male frogs:

- (1) Testes → Vasa efferentia → Kidney → Seminal Vesical → Urinogenital duct → Cloaca
- (2) Testes → Vasa efferentia → Bidder's canal → Ureter → Cloaca
- (3) Tests → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca
- (4) Tests → Bidder's canal → Kidney → Vasa efferential → Urinogenital duct → Cloaca

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Tests → Vasa efferentia → Kidney → Bidder's canal → Urinogenital duct → Cloaca	Medium	Structural Organisation In Plants And Animals

Sol. The correct route for the passage of sperm in made frog is as follows:-

Sperms are formed in the Testes, which are passed through vasa efferentia. They enter kidneys and then into Bidder's canal and finally it communicates with the Urinogenital duct and then move into Cloaca.

23. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration. Because of

- (1) inspiratory Reserve Volume.
- (2) tidal Volume.
- (3) expiratory Reserve Volume.
- (4) residual volume.

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	residual volume.	Easy	Human Physiology

Sol. Volume of air remaining in the lungs even after a forcible expiration is known as residual volume. Its average is about 1100 mL. to 1200 mL. By adding up a few respiratory volumes above, one can derive various pulmonary capacities, which can be used in clinical diagnosis.

24. Life cycle of *Ectocarpus* and *Fucus* respectively are

- (1) Diplontic, Haplodiplontic.
- (2) Haplodiplontic, Diplontic.
- (3) Haplodiplontic, Haplontic.
- (4) Haplontic, Diplontic.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Haplodiplontic, Diplontic.	Medium	Diversity In The Living World

Sol. Most algal genera shows haplontic life cycle. Exceptions been *Ectocarpus* shows Haplodiplontic life cycle whereas *Fucus* shows Diplontic life cycle.

25. Viroids differ from viruses in having

- (1) DNA molecules without protein coat.
- (2) RNA molecules with protein coat.
- (3) RNA molecules without protein coat.
- (4) DNA molecules with protein coat.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	RNA molecules without protein coat.	Easy	Diversity In The Living World

Sol. Viroids are smaller than viruses. It was found to be free RNA, it lacked the protein coat that is found in viruses.

26. Which ecosystem has the maximum biomass?

- (1) Grassland ecosystem
- (2) Pond ecosystem
- (3) Lake ecosystem
- (4) Forest ecosystem

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Forest ecosystem	Medium	Ecology

Sol. Forest ecosystem has a high biodiversity i.e. more types of living organisms. Hence forest ecosystem has the maximum biomass.

27. Asymptote in a logistic growth curve is obtained when:

- (1) $K = N$ (2) $K > N$
 (3) $K < N$ (4) The value of 'r' approaches zero

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$K = N$	Medium	Ecology

Sol. Asymptote is attained when population density (N) reaches carrying capacity (K) $\therefore K = N$

28. Alexander Von Humbolt described for the first time

- (1) Laws of limiting factor. (2) Species area relationships.
 (3) Population Growth equation. (4) Ecological Biodiversity.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Species area relationships.	Easy	Ecology

Sol. Alexander von Humboldt during his pioneering and extensive exploration in the wilderness of South American Jungles, observed that within a region, species richness increased with increasing explored area, but only upto a limit.

29. Which of the following statements is correct?

- (1) The descending limb of loop of Henle is impermeable to water.
 (2) The ascending limb of loop of Henle is permeable to water
 (3) The descending limb of loop of Henle is permeable to electrolytes.
 (4) The ascending limb of loop of Henle is impermeable to water.

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	The ascending limb of loop of Henle is impermeable to water.	Medium	Human Physiology

Sol. The descending limb of loop of Henle is permeable to water but almost impermeable to electrolytes. The ascending limb is impermeable to water but allows transport of electrolytes actively or passively.

30. The process of separation and purification of expressed protein before marketing is called

- (1) Downstream processing. (2) Bioprocessing.
 (3) Postproduction processing. (4) Upstream processing.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Downstream processing.	Easy	Biotechnology

Sol. After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product. The processes include separation and purification which are collectively referred to as downstream processing.

31. Adult human RBCs are enucleate. Which of the following statement(s) is/are most appropriate explanation for this feature?

- A) They do not need to reproduce
 B) They are somatic cells
 C) They do not metabolize
 D) All their internal space is available for oxygen transport

Options:

- (1) Only (A) (2) (A), (C) and (D) (3) (B) and (C) (4) Only (D)

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Only (D)	Medium	Human Physiology

Sol. Adult human RBCs when mature become enucleate so that the internal space is now available for oxygen transport.

32. Which of the following in sewage treatment removes suspended solids?

- (1) Secondary treatment (2) Primary treatment
(3) Sludge treatment (4) Tertiary treatment

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Primary treatment	Easy	Biology In Human Welfare

Sol. In the sewage treatment plant, primary treatment is carried out first which involves basic steps like physical removal of particles - large and small from the sewage through filtration and sedimentation.

33. Which of the following components provides sticky character to the bacterial cell?

- (1) Nuclear membrane (2) Plasma membrane
(3) Glycocalyx (4) Cell wall

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Glycocalyx	Easy	Cell : Structure And Functions

Sol. The prokaryotic cell (Bacterial cell) have cell envelope which consist of three basic layers-namely glycocalyx, cell wall and cell membrane (plasma membrane) these together act as a single protective layers. Glycocalyx help in adhesion of bacteria. Loose sheath glycocalyx is called slime layer, whereas thick and tough glycocalyx is called capsule.

34. The final proof DNA as the genetic material came from the experiments of:

- (1) Hershey and Chase (2) Avery, Mcleod and McCarty
(3) Hargobind Khorana (4) Griffith

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Hershey and Chase	Easy	Genetics And Evolution

Sol. The unequivocal proof that DNA is the genetic material and not the protein came from the experiments performed using bacteriophage by Alfred Hershey and Martha Chase.

Griffith - Proved Transforming principle

Avery, Mcleod and McCarty- Proved DNA as transforming principle

Hargobind Khorana - Deciphered complete Genetic code.

35. The region of Biosphere Reserve which is legally protected and where no human activity is allowed is known as _____.

- (1) Buffer zone (2) Transition zone
(3) Restoration zone (4) Core zone

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Core zone	Medium	Ecology

Sol. Core zone is the ecologically fragile zone which is protected by disallowing human activity.

36. During DNA replication, Okazaki fragments are used to elongate

- (1) the lagging strand towards replication fork. (2) the leading strand away from replication fork.
(3) the lagging strand away from the replication fork. (4) the leading strand towards replication fork.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	the lagging strand away from the replication fork.	Easy	Genetics And Evolution

Sol. During DNA replication, Okazaki fragment constitutes the lagging strand which is synthesized away from the replication fork.

37. Myelin sheath is produced by

- (1) astrocytes and schwann cells. (2) oligodendrocytes and osteoclasts
(3) osteoclasts and astrocytes (4) schwann cells and oligodendrocytes

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	schwann cells and oligodendrocytes	Medium	Human Physiology

Sol. The Schwann cell forms the myelin sheath around the axon in peripheral nervous system, whereas Oligodendrocytes forms the myelin sheath around the axon in central nervous system.

38. Which of the following are not polymeric?

- (1) Proteins (2) Polysaccharides (3) Lipids (4) Nucleic acids

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Lipids	Easy	Cell : Structure And Functions

Sol. Proteins are polymers of amino acids. Polysaccharides are polymers of monosaccharides. Nucleic acid are polymers of nucleotides.

39. Select the mismatch

- (1) *Cycas* Dioecious
 (2) *Salvinia* Heterosporous
 (3) *Equisetum* Homosporous
 (4) *Pinus* Dioecious

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Pinus - Dioecious	Medium	Reproduction

Sol. Pinus has male and female cones on the same plant i.e. It is monoecious

40. The association of histone H1 with a nucleosome indicates

- (1) DNA replication is occurring. (2) the DNA is condensed into a chromatin Fibre.
 (3) the DNA double helix is exposed. (4) transcription is occurring.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	the DNA is condensed into a chromatin Fibre.	Medium	Genetics And Evolution

Sol. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. Nucleosome constitute the repeating unit called chromatin which appear as 'beads-on-string' structure. The 'bead-on-string' structure in chromatin is packaged to form chromatin fibres, that are further coiled and condensed at metaphase stage of cell division to form chromosome.

41. Attractants and rewards are required for _____.

- (1) Entomophily (2) Hydrophily (3) Cleistogamy (4) Anemophily

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Entomophily	Easy	Reproduction

Sol. Anemophily i.e. wind pollination and Hydrophily i.e. Water pollination do not require attractants or remands as these are abiotic pollinating agents. Cleistogamy is self pollination in closed flower. Entomophily i.e. Insect pollination require attractants and rewards for the pollination to take place by insects.

42. Which statement is wrong for Krebs' cycle?

- (1) There is one point the cycle where FAD^+ is reduced to $FADH_2$
 (2) During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised
 (3) The cycle starts with condensation of acetyl group (acetylCOA) with pyruvic acid to yield citric acid
 (4) There are three point in the cycle where NAD^+ is reduced to $NADH + H^+$

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	The cycle starts with condensation of acetyl group (acetylCOA) with pyruvic acid to yield citric acid	Medium	Plant Physiology

Sol. The Krebs' cycle starts with the condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid.

43. Which among these is the correct combination of aquatic mammals?

- (1) Dolphins, Seals, Trygon (2) Whales, Dolphins, Seals
(3) Trygon, Whales, Seals (4) Seals, Dolphines, Sharks

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Whales, Dolphins, Seals	Medium	Diversity In The Living World

Sol. Whales, Dolphins, seals are aquatic mammals. Sharks and Trygon (sting ray) are cartilaginous fishes.

44. A temporary endocrine gland in the human body is _____.

- (1) corpus cardiacum (2) corpus luteum
(3) corpus allatum (4) pineal gland

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	corpus luteum	Medium	Human Physiology

Sol. The corpus luteum secretes large amounts of progesterone which is essential for the maintenance of the endometrium. During pregnancy all events of menstrual cycle stop and there is no menstruation. In absence of fertilization, the corpus luteum is a temporary endocrine gland in human body.

45. In case of a couple where the male is having a very low sperm count, which technique will be suitable for fertilisation?

- (1) Gamete intracytoplasmic fallopian transfer (2) Artificial Insemination
(3) Intracytoplasmic sperm injection (4) Intrauterine transfer

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Artificial Insemination	Medium	Reproduction

Sol. Treatment of infertility where the cause in low sperm count can be treated by artificial insemination. Intracytoplasmic sperm injection (ICSI) is used in cause where there is problem with male partner to inseminate. GIFT is used as treatment when the female cannot produce ovum but can provide suitable environment for fertilization and further development.

46. Coconut fruit is a _____.

- (1) Berry (2) Nut (3) Capsule (4) Drupe

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Drupe	Easy	Structural Organisation In Plants And Animals

Sol. Coconut is a fibrous drupe with a fibrous mesocarp.

47. Capacitation occurs in _____.

- (1) Epididymis (2) Vas deferens
(3) Female Reproductive tract (4) Rate testis

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Female Reproductive tract	Hard	Reproduction

Sol. Capacitation refers to the physiological changes that a sperm must undergo in order to have the ability to penetrate and fertilize an egg. Capacitation occurs in the female reproductive system where they get ready for fertilization.

48. Hypersecretion of growth hormone in adults does not cause further increase in height because

- (1) epiphyseal plates close after adolescence.
(2) bones loose their sensitivity to growth Hormone in adults.
(3) muscle fibres do not grow in size after birth.
(4) growth Hormone becomes inactive in adults.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	epiphyseal plates close after adolescence.	Hard	Human Physiology

Sol. Hypersecretion of growth hormone in adults does not cause further increase in height because the epiphyseal plates close after adolescence. Hypersecretion of Growth Hormone in adults leads to severe disfigurement (especially of the face) called acromegaly.

49. The DNA fragments separated on an agarose gel can be visualized after staining with _____.

- (1) Acetocarmine (2) Aniline blue
(3) Ethidium bromide (4) Bromophenol blue

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Ethidium bromide	Easy	Biotechnology

Sol. Among the given four options ethidium bromide is the only one that binds with DNA and enhances fluorescence in uv light.

50. Match the following sexually transmitted diseases (Column-I) with their causative agent (Column -II) and select the correct option.

	Column-I		Column-II
A)	Gonorrhoea	I.	HIV
B)	Syphilis	II.	<i>Neisseria</i>
C)	Genital Warts	III.	<i>Treponema</i>
D)	AIDS	IV.	Human Papilloma-Virus

Options:

	A	B	C	D
(1)	(III)	(IV)	(I)	(II)
(2)	(IV)	(II)	(III)	(I)
(3)	(IV)	(III)	(II)	(I)
(4)	(II)	(III)	(IV)	(I)

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	(II); (III); (IV); (I)	Medium	Biology In Human Welfare

Sol. All of the following are sexually transmitted diseases caused by their respective micro-organisms
 Gonorrhoea - *Neisseria pallidum*
 Syphilis - *Treponema pallidum*
 Genital warts - Human papilloma virus.
 AIDS - Human Immuno-deficiency virus.

51. Select the mismatch:

(1)	<i>Rhodospirillum</i>	Mycorrhiza
(2)	<i>Anabaena</i>	Nitrogen fixer
(3)	<i>Rhizobium</i>	Alfalfa
(4)	<i>Frankia</i>	<i>Alnus</i>

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	<i>Rhodospirillum</i> - Mycorrhiza	Medium	Plant Physiology

Sol. *Glomus* - Mycorrhiza
Rhodospirillum & *Anabaena* - Nitrogen fixer
Rhizobium - Alfalfa
Frankia - *Alnus*.

62. *GnRH*, a hypothalamic hormone, needed in reproduction, acts on

- (1) anterior pituitary gland and stimulates secretion of LH and FSH.
- (2) posterior pituitary gland and stimulates secretion of oxytocin and FSH.
- (3) posterior pituitary gland and stimulates secretion of LH and relaxin.
- (4) Anterior pituitary gland and stimulates secretion of LH and oxytocin.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	anterior pituitary gland and stimulates secretion of LH and FSH.	Medium	Human Physiology

Sol. *GnRH*, a hypothalamic hormone, stimulates anterior pituitary gland and they release *LH* and *FSH*, which stimulates the gonadal activity and hence are Gonadotrophins.

63. Fruit and leaf drop at early stages can be prevented by the application of _____.

- (1) ethylene (2) auxins (3) gibberellic acid (4) cytokinins

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	auxins	Medium	Plant Physiology

Sol. Auxins helps to prevent fruit and leaf drop at early stage but promote the abscission of older mature leaves and fruits.

64. Out of 'X' pairs of ribs in humans only 'Y' pairs are true ribs. Select the portion that correctly represents values of X and Y and provides their explanation:

- A) $X = 12, Y = 5$ True ribs are attached dorsally to vertebral column and sternum on the tow ends.
- B) $X = 24, Y = 7$ True ribs are dorsally attached to vertebral column but are free on ventral side.
- C) $X = 24, Y = 12$ True ribs are dorsally attached to vertebral column but are free on ventral side.
- D) $X = 12, Y = 7$ True ribs are attached dorsally to vertebral column and ventrally to the sternum.

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	$X = 12, Y = 7$ - True ribs are attached dorsally to vertebral column and ventrally to the sternum.	Medium	Human Physiology

Sol. There are 12 pairs of ribs. Each ribs is a thin flat bone connected dorsally to the vertebral column and ventrally to the sternum. First seven pairs of ribs are called true ribs. Dorsally, they are attached to the thoracic vertebrae and ventrally connected to the sternum with the help of hyaline cartilage.

65. If there are 999 bases in an RNA that codes for a protein with 333 amino acids, and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered?

- (1) 11 (2) 33 (3) 333 (4) 1

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	33	Hard	Genetics And Evolution

Sol. 999 Bases = 333 amino acids = 333 codon
 900 Bases = 300 codon = 300 amino acids
 Base at position 901 is deleted
 Codon that will be altered
 = 999 bases - 900 bases
 = 333 - 300
 = 33 codon

66. Which of the following cell organelles is responsible for extracting energy from carbohydrates to form ATP?

- (1) Ribosome (2) Chloroplast (3) Mitochondrion (4) Lysosome

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Mitochondrion	Easy	Cell : Structure And Functions

Sol. Mitochondria are the site of aerobic respiration. They are the power house of the cell, that is the site of ATP synthesis by oxidative phosphorylation.

67. DNA fragments are

- (1) Negatively charged.
 (2) Neutral.
 (3) Either positively or negatively charged depending on their size.
 (4) Positively charged.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Negatively charged.	Easy	Genetics And Evolution

Sol. Phosphate group in DNA is the reason for its negative change. Phosphodiester bond is the one that keeps the nucleotide and DNA within the nuclear membrane.

68. The genotypes of a Husband and Wife are $I^B I^B$ and $I^A i$.

Among the blood types of their children, how many different genotypes and phenotypes are possible?

- (1) 3 genotypes; 4 phenotypes (2) 4 genotypes; 3 phenotypes
 (3) 4 genotypes; 4 phenotypes (4) 3 genotypes; 3 phenotypes

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	4 genotypes; 3 phenotypes	Hard	Genetics And Evolution

Sol. Husband Wife

Genotype	$I^A I^B$	$I^A i$
Gamete	$I^A I^B$	$I^A i$
F_1 Generation	$I^A I^A I^A i$	$I^A I^B I^B i$
Genotype = 4	$(I^A I^A, I^A i, I^A I^B, I^B i)$	
Phenotype = 3	$\left(\begin{array}{l} A = I^A I^A, I^A i, \\ B = I^B i, \\ AB = I^A I^B \end{array} \right)$	

69. The pivot joint between atlas and axis is a type of _____.

- (1) cartilaginous joint (2) synovial joint
 (3) saddle joint (4) fibrous joint

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	synovial joint	Easy	Human Physiology

Sol. The pivot joint between atlas and axis is a type of synovial joint.

70. Double fertilization is exhibited by:

- (1) Algae (2) Fungi
 (3) Angiosperms (4) Gymnosperms

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Fungi	Easy	Diversity In The Living World

Sol. Double fertilization involving syngamy and triple fusion is an unique feature of angiosperm.

71. The water potential of pure water is

- (1) less than zero. (2) more than zero but less than one.
 (3) more than one. (4) zero.

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	zero.	Easy	Plant Physiology

Sol. Water potential is the stored free energy of water. It is maximum for pure water and its value is zero.

72. A dioecious flowering plant prevents both

- (1) Autogamy and geitonogamy. (2) Geitonogamy and xenogamy.
 (3) Cleistogamy and xenogamy. (4) Autogamy and xenogamy.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Autogamy and geitonogamy.	Medium	Reproduction

Sol. In plant like papaya, male and female flower are present on different plants, that is each plant is either male or female. This condition prevents both autogamy and geitonogamy.

73. Which of the following options gives the correct sequence of events during mitosis?

- (1) Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase
 (2) Condensation → crossing over → nuclear membrane disassembly → segregation → telophase
 (3) Condensation → arrangement at equator → centromere division → segregation → telophase
 (4) Condensation → nuclear membrane disassembly → crossing over → segregation → telophase

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Condensation → nuclear membrane disassembly → arrangement at equator → centromere division → segregation → telophase	Easy	Cell : Structure And Functions

Sol. Mitosis is divided into four stages:

- 1) Prophase – Chromosome condensation occurs, simultaneously the centrioles moves to the opposite poles. The nuclear envelope and the nucleolus disappear and the spindle fibres start appearing
- 2) Meta phase – Alignment of chromosome at the equatorial plate
- 3) Anaphase-Centromere divide and the chromatid start moving towards opposite pole.
- 4) Telophase - Chromosomal elongation start, nucleolus and nuclear membrane reappear.

74. The vascular cambium normally gives rise to _____.

- (1) Primary phloem (2) Secondary xylem
 (3) Periderm (4) Phelloderm

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Secondary xylem	Medium	Structural Organisation In Plants And Animals

Sol. The vascular cambium normally gives rise to secondary xylem. It is the source of both secondary xylem growth inwards towards the pith, and secondary phloem growth outwards to the bark.

75. Which one from those given below is the period for Mendel's hybridization experiments?

- (1) 1840 - 1850 (2) 1857 - 1869 (3) 1870 - 1877 (4) 1856 - 1863

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	1856 - 1863	Easy	Genetics And Evolution

Sol. Gregor Mendel, conducted hybridization experiments on garden pea for seven years (1856-1863) and proposed the law of inheritance in living organism.

76. Which of the following options best represents the enzyme composition of pancreatic juice?

- (1) Amylase, pepsin, trypsinogen, maltase
 (2) Peptidase, amylase, pepsin, rennin
 (3) Lipase, amylase, trypsinogen, procarboxypeptidase
 (4) Amylase, peptidase, trypsinogen, rennin

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Lipase, amylase, trypsinogen, procarboxypeptidase	Medium	Human Physiology

Sol. The pancreatic juice contains enzymes trypsinogen, lipase, amylase and procarboxypeptidase and nuclease for digestion of proteins, carbohydrate, lipids and nucleic acid.

77. The morphological natural of the edible part of coconut is _____.

- (1) cotyledon (2) endosperm (3) pericarp (4) perisperm

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	endosperm	Easy	Reproduction

Sol. Edible part of coconut is liquid endosperm that is coconut water and cellular endosperm that is coconut meat.

78. Which of the following RNAs should be most abundant in animal cell?

- (1) t-RNA (2) m-RNA (3) mi-RNA (4) r-RNA

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	r-RNA	Easy	Genetics And Evolution

Sol. r-RNA constitute 80% of total cellular RNA.
t-RNA constitute 10-20% of total cellular RNA.
m-RNA constitute 3-5% of total cellular RNA.

79. The hepatic portal vein drains blood to liver from _____.

- (1) stomach (2) kidneys (3) intestine (4) heart

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	intestine	Easy	Human Physiology

Sol. The hepatic portal vein carries blood form intestine to the liver before it is delivered to the systemic circulation.

80. Which of the following represents order of 'Horse'?

- (1) Perissodactyla (2) *Caballus* (3) *Ferus* (4) Equidae

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Perissodactyla	Hard	Diversity In The Living World

Sol. Orders of Horse-Perissodactyla
Family-Equidae
Subspecies-Caballus
Species-E. Ferus.

81. MALT constitutes about _____ percent of the lymphoid tissue in human body.

- (1) 20% (2) 70% (3) 10% (4) 50%

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	50%	Easy	Biology In Human Welfare

Sol. There is lymphoid tissue located within the lining of the major tracts (respiratory, digestive, and urogenital tracts) called mucosa-associated lymphoid tissue (MALT). It constitute absent 50% of the lymphoid tissue in human body.

82. Which of the following are found in extreme saline condition?

- (1) Eubacteria (2) Cyanobacteria (3) Mycobacteria (4) Archaeobacteria

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Archaeobacteria	Easy	Diversity In The Living World

Sol. Archaeobacteria are found in extreme conditions such as extremely high temperature, high salinity or acidity.

83. Which of the following facilitates opening of stomatal aperture?

- (1) Decrease in turgidity of guard cells
- (2) Radial orientation of cellulose microfibrils in the cell wall of guard cells
- (3) Longitudinal orientation of cellulose microfibrils in the cells wall of guard cells
- (4) Contraction of outer wall of guard cells

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Radial orientation of cellulose microfibrils in the cell wall of guard cells	Medium	Plant Physiology

Sol. The inner wall of guard cell toward the pore or stomatal aperture, is thick and elastic. The opening of the stoma is also aided due to the orientation of the microfibrils in the cell wall of the guard cells. Cellulose microfibrils are oriented radially rather than longitudinally making it easier for the stoma to open.

84. Which of the following is correctly matched for the product produced by them?

- (1) *Metanobacterium* : Lactic acid
- (2) *Penicillium notatum* : Acetic acid
- (3) *Sacchromyces cerevisiae* : Ethanol
- (4) *Acetobacter aceti* : Antibiotics

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	<i>Sacchromyces cerevisiae</i> : Ethanol	Easy	Biology In Human Welfare

Sol. *Metanobacterium* - Biogas
Penicillium notatum - Penicillin
Acetobacter acetic - Acetic acid.

85. Artificial selection to obtain cows yielding higher milk output represent

- (1) directional as it pushes the mean of the character in one direction.
- (2) disruptive as it splits the population into two, one yielding higher output and the other lower output.
- (3) Stabilizing followed by disruptive as it stabilizes the population to produce higher yielding cows.
- (4) Stabilizing selection as it stabilizes this character in the population.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	directional as it pushes the mean of the character in one direction.	Hard	Genetics And Evolution

Sol. Artificial selection to obtain cows yielding higher milk output represent directional as it pushes the mean of the character in one direction (more individuals acquire value other than the mean character value).

86. Receptor sites for neurotransmitters are present on

- (1) pre-synaptic membrane.
- (2) tips of axons.
- (3) post-synaptic membrane.
- (4) membranes of synaptic vesicles.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	post-synaptic membrane.	Easy	Human Physiology

Sol. The released neurotransmitter bind to their specific receptor, present on the post synaptic membrane.

87. An important characteristic that Hemichordates share with Chordates is

- (1) ventral tubular nerve cord.
- (2) pharynx with gill slits.
- (3) pharynx without gill slits.
- (4) absence of notochord.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	pharynx with gill slits.	Medium	Diversity In The Living World

Sol. In case of hemichordates and chordates, pharynx is perforated by gill slits.

88. Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune-response is responsible for such rejections?

- (1) Cell-mediated immune response (2) Hormonal immune response
 (3) Physiological immune response (4) Autoimmune response

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Cell-mediated immune response	Easy	Biology In Human Welfare

Sol. Transplantation of tissues/organs fails due to cell mediated immune response. This immune response helps the body to differentiate between self and non self cell.

89. Spliceosomes are not found in cells of _____.

- (1) fungi (2) animals (3) bacteria (4) plants

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	bacteria	Medium	Genetics And Evolution

Sol. The main function of splice some is to remove introns. Introns are the sequences that do not appear in mature or proceeded RNA. The remaining fragments that are rejoined are known as exons. Exons are the sequence that appear in mature or processed RNA. Since, bacteria i.e. prokaryotic cell do not consists of introns, splice some is absent.

90. Phosphoenol pyruvate (PEP) is the primary CO_2 acceptor in _____.

- (1) C_4 plants (2) C_2 plants (3) C_3 and C_4 plants (4) C_3 plants

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	C_4 plants	Easy	Plant Physiology

Sol. Phosphoenol pyruvate is a three carbon compound. Phosphoenol pyruvate is the primary carbon dioxide acceptor in the mesophyll cell of C_4 plants like sugarcane.

SUBJECT – 2: PHYSICS

91. Suppose the charge of a proton and an electron differ slightly. One of them is $-e$, the other is $(e + \Delta e)$. If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is the order of [Given mass of hydrogen $m_h = 1.67 \times 10^{-27} \text{ kg}$].

- (1) 10^{-23} C (2) 10^{-37} C (3) 10^{-47} C (4) 10^{-20} C

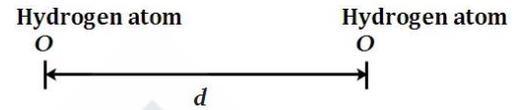
Answer Key	Answer	Difficulty Level	Chapter Name
(2)	10^{-37} C	Easy	Electrostatics

Sol. According to the question,

Net electrostatics force = Net gravitational force

$$\text{i.e., } \frac{(\Delta e)^2}{4\pi \epsilon_0 d^2} = \frac{Gm_h^2}{d^2}$$

$$\Delta e = \sqrt{Gm_h^2 \times 4\pi \epsilon_0} = \sqrt{6.67 \times 10^{-11} \times (1.67 \times 10^{-27})^2 \times \frac{1}{9 \times 10^9}} = 1.43766 \times 10^{-37} \text{ C}$$



92. A potentiometer is an accurate and versatile device to make electrical measurements of E.M.F. because the method involves:

- (1) potential gradients
- (2) a condition of no current flow through the galvanometer
- (3) a combination of cells, galvanometer and resistances
- (4) cells

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	a condition of no current flow through the galvanometer	Easy	Current Electricity

Sol. Since, $V = \epsilon - ir$

Where, ϵ is the emf, V is the terminal voltage and i_r is the internal resistance.

Since, Voltmeter required current, therefore it measured terminal voltage which is smaller than the emf .

Since, in case of potentiometer, we balance the emf , as current through the galvanometer does not pass i.e., $i = 0$.

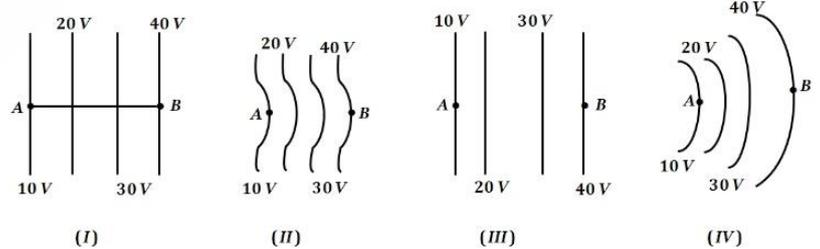
Therefore the voltage measured by it is the emf .

Hence, reading of potentiometer is accurate because during taking reading, it does not draw any current from the circuit.

93. The diagrams below show regions of equipotentials.

A positive charge is moved from A to B in each diagram

- (1) In all the four cases the work done is the same.
- (2) Minimum work is required to move q in figure (I)
- (3) Maximum work is required to move q in figure (II)
- (4) Maximum work is required to move q in figure (III)



Answer Key	Answer	Difficulty Level	Chapter Name
(1)	In all the four cases the work done is the same.	Easy	Electrostatics

Sol. Work done, $W = q\Delta V$

ΔV is same in all the cases so work done will be same in all the cases.

94. The de-Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature T (Kelvin) and mass m , is:

- (1) $\frac{h}{\sqrt{3mkT}}$ (2) $\frac{2h}{\sqrt{3mkT}}$ (3) $\frac{2h}{\sqrt{mkT}}$ (4) $\frac{h}{\sqrt{mkT}}$

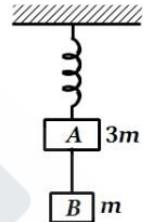
Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$\frac{h}{\sqrt{3mkT}}$	Medium	Modern Physics

Sol. de-Broglie wavelength

$$\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2m(KE)}} = \frac{h}{\sqrt{2m(\frac{3}{2}kT)}}$$

$$\lambda = \frac{h}{\sqrt{3mkT}}$$

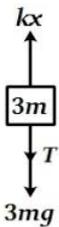
95. Two blocks A and B of masses $3m$ and m respectively are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in figure. The magnitudes of acceleration of A and B immediately after the string is cut, are respectively:



- (1) $\frac{g}{3}, g$
 (2) g, g
 (3) $\frac{g}{3}, \frac{g}{3}$
 (4) $g, \frac{g}{3}$

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$\frac{g}{3}, g$	Medium	Dynamics of Motion

Sol.



Before the string is cut,

$$kx = T + 3mg$$

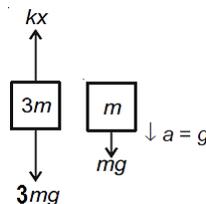
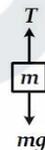
$$T = mg$$

$$\Rightarrow kx = 4mg$$

After the string is cut, $T = 0$

$$a = \frac{kx - 3mg}{3m} = \frac{4mg - 3mg}{3m}$$

$$a = \frac{g}{3} \uparrow$$



96. The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000 \text{ \AA}$ and $\lambda_2 = 6000 \text{ \AA}$ is:

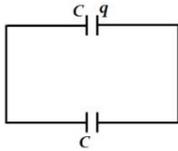
- (1) 9 : 4 (2) 3 : 2 (3) 16 : 81 (4) 8 : 27

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	3 : 2	Easy	Wave optics

Sol. Resolving power $\propto \frac{1}{\lambda}$

$$\therefore \frac{R_1}{R_2} = \frac{\lambda_2}{\lambda_1} = \frac{6000 \text{ \AA}}{4000 \text{ \AA}} = \frac{3}{2}$$

When it is connected with another uncharged capacitor.



$$V_c = \frac{q_1 + q_2}{C_1 + C_2} = \frac{q + 0}{C + C}$$

$$V_c = \frac{V}{2}$$

Initial energy,

$$U_i = \frac{1}{2} CV^2$$

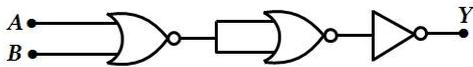
Final energy,

$$U_f = \frac{1}{2} C \left(\frac{V}{2}\right)^2 + \frac{1}{2} C \left(\frac{V}{2}\right)^2 = \frac{CV^2}{4}$$

$$\text{Loss of energy} = U_i - U_f = \frac{CV^2}{4}$$

i.e., decreases by a factor (2).

100. The given electrical network is equivalent to:



(1) OR gate

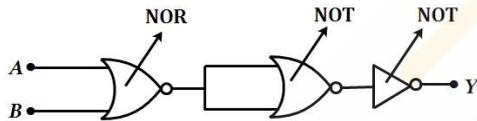
(2) NOR gate

(3) NOT gate

(4) AND gate

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	NOR gate	Medium	Semiconductors

Sol.



The first gate will be *NOR* gate.

The second gate is *NOR* gate but the inputs of this gate are combined, therefore this gate will become the *NOT* gate.

The third gate will be *NOT* gate.

In this question, one *NOT* gate is followed by another *NOT* gate. Therefore, it will nullify each other, and the left gate will be *NOR* gate.

Hence, the appropriate option will be *NOT* gate.

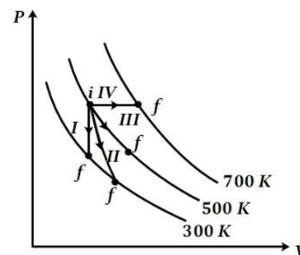
101. Thermodynamic processes are indicated in the following diagram.

Match the following:

Column - 1

Column - 2

- | | |
|----------------|---------------|
| P) Process I | a) Adiabatic |
| Q) Process II | b) Isobaric |
| R) Process III | c) Isochoric |
| S) Process IV | d) Isothermal |



(1) P→c, Q→a, R→d, S→b

(2) P→c, Q→d, R→b, S→a

(3) P→d, Q→b, R→a, S→c

(4) P→a, Q→c, R→d, S→b

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	P→c, Q→a, R→d, S→b	Easy	Thermodynamics

Sol. Process I = Isochoric

Process II = Adiabatic

Process III = Isothermal

Process IV = Isobaric

102. A physical quantity of the dimensions of length that can be formed out of c, G and $\frac{e^2}{4\pi\epsilon_0}$ is [c is velocity of light, G is universal constant of gravitation and e is charge]:

- (1) $c^2 \left[G \frac{e^2}{4\pi\epsilon_0} \right]^{1/2}$ (2) $\frac{1}{c^2} \left[\frac{e^2}{G 4\pi\epsilon_0} \right]^{1/2}$ (3) $\frac{1}{c} G \frac{e^2}{4\pi\epsilon_0}$ (4) $\frac{1}{c^2} \left[G \frac{e^2}{4\pi\epsilon_0} \right]^{1/2}$

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	$\frac{1}{c^2} \left[G \frac{e^2}{4\pi\epsilon_0} \right]^{1/2}$	Hard	Units and Dimensions

Sol. Let $\frac{e^2}{4\pi\epsilon_0} = A = ML^3T^{-2}$

$$L = c^x G^y (A)^z$$

$$L = [LT^{-1}]^x [M^{-1}L^3T^{-2}]^y [ML^3T^{-2}]^z$$

$$-y + z = 0 \Rightarrow y = z \quad \text{(i)}$$

$$x + 3y + 3z = 1 \quad \text{(ii)}$$

$$-x - 4z = 0 \quad \text{(iii)}$$

From (i), (ii) & (iii)

$$z = y = \frac{1}{2}, x = -2$$

103. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm . What is the angular acceleration of the cylinder if the rope is pulled with a force of 30 N ?

- (1) 0.25 rad/s^2 (2) 25 rad/s^2 (3) 5 m/s^2 (4) 25 m/s^2

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	25 rad/s^2	Medium	Rotation

Sol. $\tau = I\alpha$

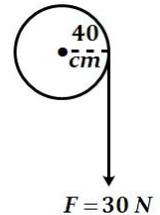
$$F \times R = MR^2\alpha$$

$$30 \times 0.4 = 3 \times (0.4)^2\alpha$$

$$12 = 3 \times 0.16\alpha$$

$$400 = 16\alpha$$

$$\alpha = 25 \text{ rad/s}^2$$



104. In an electromagnetic wave in free space the root mean square value of the electric field is $E_{rms} = 6 \text{ V/m}$. The peak value of the magnetic field is:

- (1) $2.83 \times 10^{-8} \text{ T}$ (2) $0.70 \times 10^{-8} \text{ T}$
 (3) $4.23 \times 10^{-8} \text{ T}$ (4) $1.41 \times 10^{-8} \text{ T}$

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$2.83 \times 10^{-8} \text{ T}$	Medium	Electromagnetic Wave

Sol. As we know,

$$\frac{E_{rms}}{B_{rms}} = c$$

where, E_{rms} = Root mean square of electric field, B_{rms} = Root mean square of magnetic field and c = speed of light.

According to the question,

$$\frac{6}{B_{rms}} = 3 \times 10^8$$

$$B_{rms} = 2 \times 10^{-8} \text{ T}$$

As we know,

$$B_{rms} = \frac{B_0}{\sqrt{2}}$$

where, B_0 = Peak value of magnetic field.

$$\therefore B_0 = \sqrt{2} \times B_{rms}$$

$$= \sqrt{2} \times 2 \times 10^{-8} \text{ T}$$

$$= 2.828 \times 10^{-8} \text{ T}$$

where, \dot{Q} =Rate of energy Radiated, A =Area of the body, σ =Stefan's constant, e =emissive power of the body and T =Temperature of the body

Since, $\dot{Q} = \sigma e(4\pi R^2)T^4$

According to the question,

$$\frac{\dot{Q}_1}{\dot{Q}_2} = \frac{\sigma e(4\pi R_1^2)T_1^4}{\sigma e(4\pi R_2^2)T_2^4}$$

$$\frac{450}{\dot{Q}_2} = \frac{R_1^2 T_1^4}{R_2^2 T_2^4} = \frac{R_1^2 \cdot T_1^4}{\left(\frac{R_1}{2}\right)^2 \cdot (2T_1)^4} = \frac{R_1^2 \times 4 \times T_1^4}{R_1^2 \times 16T_1^4} = \frac{1}{4}$$

$$\dot{Q}_2 = 4\dot{Q}_1 = 4 \times 450 \text{ W} = 1800 \text{ W}$$

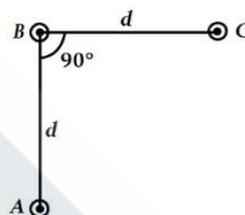
109. An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current 'I' along the same direction is shown in Fig. Magnitude of force per unit length on the middle wire 'B' is given by:

(1) $\frac{2\mu_0 i^2}{\pi d}$

(2) $\frac{\sqrt{2}\mu_0 i^2}{\pi d}$

(3) $\frac{\mu_0 i^2}{\sqrt{2}\pi d}$

(4) $\frac{\mu_0 i^2}{2\pi d}$



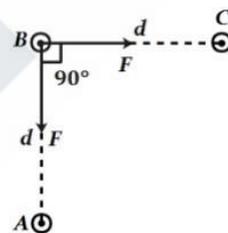
Answer Key	Answer	Difficulty Level	Chapter Name
(3)	$\frac{\mu_0 i^2}{\sqrt{2}\pi d}$	Medium	Magnetic Effect of Electric Current

Sol. Force between BC and AB will be same in magnitude.

$$F_{BC} = F_{BA} = \frac{\mu_0 i^2}{2\pi d}$$

$$F = \sqrt{2}F_{BC} = \sqrt{2} \frac{\mu_0 i^2}{2\pi d}$$

$$\text{or, } F = \frac{\mu_0 i^2}{\sqrt{2}\pi d}$$



110. A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is:

(1) 15 RT

(2) 9 RT

(3) 11 RT

(4) 4 RT

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	11 RT	Easy	Thermal Properties of Matter

Sol. As we know, oxygen is the di-atomic gas, therefore the internal energy of 1 mole of oxygen atom is $\frac{5}{2}RT$ and argon atom is a mono-atomic gas, so the internal energy of 1 mole of argon atom is $\frac{3}{2}RT$

$$\therefore \text{Total energy of the system} = n_1 \times \frac{5}{2}RT + n_2 \times \frac{3}{2}RT$$

$$= 2 \times \frac{5}{2}RT + 4 \times \frac{3}{2}RT$$

$$= 5RT + 6RT = 11RT$$

111. The bulk modulus of a spherical object is 'B'. If it is subjected to uniform pressure 'p', the fractional decrease in radius is:

(1) $\frac{B}{3p}$

(2) $\frac{3p}{B}$

(3) $\frac{p}{3B}$

(4) $\frac{p}{B}$

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	$\frac{p}{3B}$	Medium	Mechanical Properties of Solid

Sol. As we know, Bulk modulus, $B = \frac{p}{\frac{\Delta V}{V}}$

$$\therefore V = \frac{4}{3}\pi R^3$$

Since, $\frac{\Delta V}{V} = 3 \frac{\Delta R}{R}$ (Relative error)

$\therefore B = \frac{p}{-3 \frac{\Delta R}{R}}$

$\frac{\Delta R}{R} = -\frac{p}{3B}$ (Negative sign shows decrease in radius)

112. In a common emitter transistor amplifier the audio signal voltage across the collector is 3 V. The resistance of collector is 3 kΩ. If current gain is 100 and the base resistance is 2 kΩ, the voltage and power gain of the amplifier is:

- (1) 15 and 200 (2) 150 and 15000 (3) 20 and 2000 (4) 200 and 1000

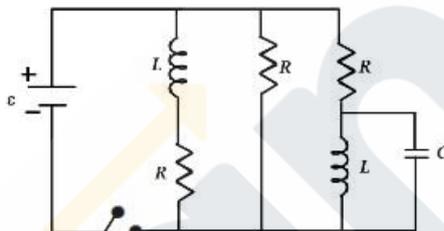
Answer Key	Answer	Difficulty Level	Chapter Name
(2)	150 and 15000	Medium	Semiconductors

Sol. Current gain (β) = 100

Voltage gain (A_V) = $\beta \frac{R_c}{R_b} = 100 \left(\frac{3}{2}\right) = 150$

Power gain = $A_V \beta = 150(100) = 15000$

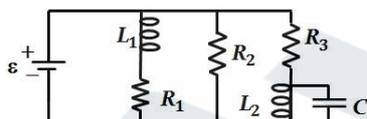
113. Figure shows a circuit that contains three identical resistors with resistance $R = 9.0 \Omega$ each, two identical inductors with inductance $L = 2.0 \text{ mH}$ each, and an ideal battery with emf $\varepsilon = 18 \text{ V}$. The current 'i' through the battery just after the switch closed is,



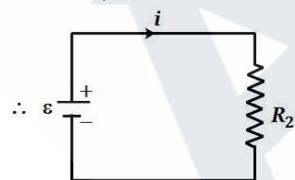
- (1) 0.2 A (2) 2 A (3) 0 A (4) 2 mA

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	2 A	Medium	AC Circuit

Sol.



At $t = 0$, no current flows through R_1 and R_3



$i = \frac{\varepsilon}{R_2} = \frac{18}{9} = 2 \text{ A}$

114. Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340 m/s]:

- (1) 361 Hz (2) 411 Hz (3) 448 Hz (4) 350 Hz

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	448 Hz	Medium	Wave

Sol. $f_A = f \left[\frac{v+v_0}{v-v_s} \right]$

$\therefore f_A = 400 \left[\frac{340 + 16.5}{340 - 22} \right] = 448 \text{ Hz}$

If the object is placed in a non-uniform gravitational field then in this case the center of mass and center of gravity does not coincide.

If the body is very large compared to the size of the earth then in that case center of mass does not coincide with the center of gravity as the value of acceleration due to gravity goes on changing with respect to the height, as when we go up.

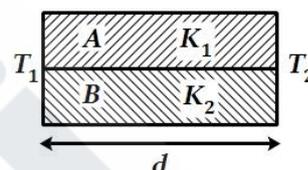
In the case of symmetric body, center of mass and center of gravity does not coincide but they both lies in a same vertical line, and therefore the torque due to the weight about the center of mass will be zero.

A couple on a body only produce the rotational motion of the body.

Mechanical advantage = $\frac{\text{Output}}{\text{Input}} > 1$, means $\text{Output} > \text{Input}$, which implies that the small effort can be used to lift a large load.

For example: Lever

118. Two rods A and B of different materials are welded together as shown in figure. Their thermal conductivities are K_1 and K_2 . The thermal conductivity of the composite rod will be:



- (1) $\frac{3(K_1+K_2)}{2}$ (2) $K_1 + K_2$
 (3) $2(K_1 + K_2)$ (4) $\frac{K_1+K_2}{2}$

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	$\frac{K_1 + K_2}{2}$	Medium	Thermal Properties of Matter

Sol. Net amount of heat passed through the composite rod = Amount of heat passed through the rod A + Amount of heat passed through the rod B.

$$\text{i.e., } H = H_1 + H_2$$

$$\frac{K_{eq} 2A(T_1 - T_2)}{d} = \frac{K_1 A(T_1 - T_2)}{d} + \frac{K_2 A(T_1 - T_2)}{d}$$

$$\frac{K_{eq} 2A(T_1 - T_2)}{d} = \frac{A(T_1 - T_2)}{d} [K_1 + K_2]$$

$$K_{eq} = \frac{K_1 + K_2}{2}$$

119. The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then:

- (1) $d = 1 \text{ km}$ (2) $d = \frac{3}{2} \text{ km}$ (3) $d = 2 \text{ km}$ (4) $d = \frac{1}{2} \text{ km}$

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	$d = 2 \text{ km}$	Easy	Gravitation

Sol. Above the earth surface

$$g' = g \left(1 - \frac{2h}{R_e}\right)$$

Below the earth surface,

$$g'' = g \left(1 - \frac{d}{R_e}\right)$$

According to the question,

$$g' = g''$$

$$\text{i.e., } g \left(1 - \frac{2h}{R_e}\right) = g \left(1 - \frac{d}{R_e}\right)$$

$$\frac{2h}{R_e} = \frac{d}{R_e}$$

$$\frac{2 \times 1 \times 10^3}{R_e} = \frac{d}{R_e}$$

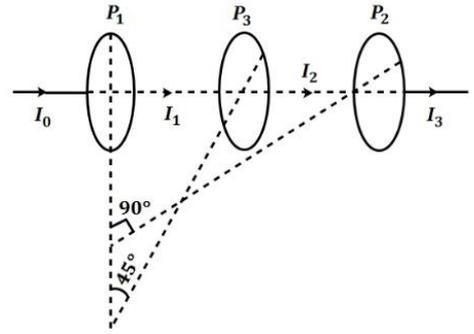
$$d = 2 \times 10^3 \text{ m} = 2 \text{ km}$$

Sol.

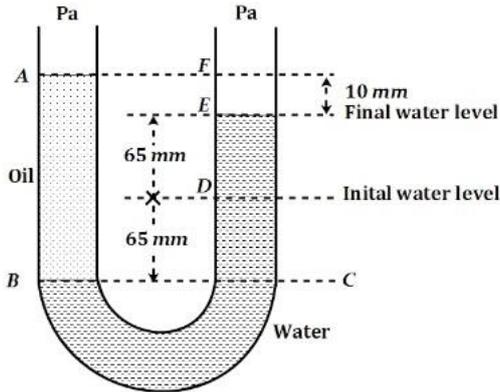
$$I_2 = \frac{I_0}{2} \cos^2 45^\circ = \frac{I_0}{2} \times \frac{1}{2} = \frac{I_0}{4}$$

$$I_3 = \frac{I_0}{4} \cos^2 45^\circ$$

$$I_3 = \frac{I_0}{8}$$



124. A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is :



- (1) 425 kg m^{-3} (2) 800 kg m^{-3} (3) 928 kg m^{-3} (4) 650 kg m^{-3}

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	928 kg m^{-3}	Medium	Mechanical properties of Fluid

Sol. $h_{oil} \times \rho_{oil} \times g = h_{water} \times \rho_{water} \times g$
 or, $140 \times \rho_{oil} = 130 \times \rho_{water}$
 or, $\rho_{oil} = \frac{13}{14} \times 1000 \text{ kg/m}^3 = 928 \text{ kg m}^{-3}$

125. A thin prism having refracting angle 10° is made of glass of refractive index 1.42. This prism is combined with another thin prism of glass of refractive index 1.7. This combination produces dispersion without deviation. The refracting angle of second prism should be :

- (1) 6° (2) 8° (3) 10° (4) 4°

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	6°	Easy	Ray optics

Sol. The condition of dispersion without deviation is given by,

$$|(\mu_1 - 1)A_1| = |(\mu_2 - 1)A_2|$$

$$(1.42 - 1) \times 10^\circ = (1.7 - 1) \times A_2$$

$$A_2 = \frac{0.42 \times 10^\circ}{0.7} = 6^\circ$$

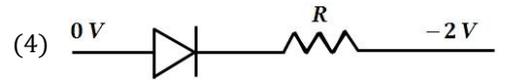
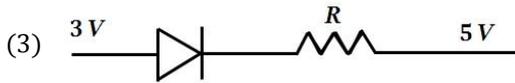
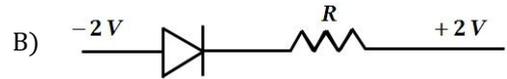
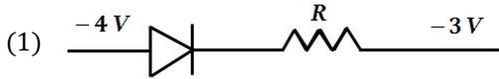
126. If θ_1 and θ_2 be the apparent angles of dip observed in two vertical planes at right angles to each other, then the true angle of dip θ is given by:

- (1) $\tan^2 \theta = \tan^2 \theta_1 + \tan^2 \theta_2$ (2) $\cot^2 \theta = \cot^2 \theta_1 - \cot^2 \theta_2$
 (3) $\tan^2 \theta = \tan^2 \theta_1 - \tan^2 \theta_2$ (4) $\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	$\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$	Medium	Magnetism and matter

Sol. $\cot^2 \theta = \cot^2 \theta_1 + \cot^2 \theta_2$

127. Which one of the following represents forward bias diode?



Answer Key	Answer	Difficulty Level	Chapter Name
(4)		Easy	Semiconductors

Sol. In forward bias, P -type semiconductor is at higher potential with respect to n -type semiconductor.

128. Consider a drop of rain water having mass 1 g falling from a height of 1 km . It hits the ground with a speed of 50 m/s . Take ' g ' constant with a value 10 m/s^2 . The work done by the (i) gravitational force and the (ii) resistive force of air is:

(1) (i) 1.25 J , (ii) -8.25 J

(2) (i) 100 J , (ii) 8.75 J

(3) (i) 10 J , (ii) -8.75 J

(4) (i) -10 J , (ii) -8.25 J

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	(i) -10 J , (ii) -8.25 J	Medium	Work, Energy, Power & Momentum

Sol. $W_g + W_a = K_f - k_i$

$$mgh + W_a = \frac{1}{2}mv^2 - 0$$

$$10^{-3} \times 10 \times 10^3 + w_a = \frac{1}{2} \times 10^{-3} \times (50)^2$$

$$W_a = -8.75\text{ J} \text{ i.e., work done due to air resistance and work done due to gravity} = 10\text{ J}.$$

129. One end of string of length l is connected to a particle of mass ' m ' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed ' v ', the net force on the particle (directed towards center) will be (T represents the tension in the string).

(1) $T + \frac{mv^2}{l}$

(2) $T - \frac{mv^2}{l}$

(3) Zero

(4) T

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	T	Medium	Dynamics of Motion

Sol. Centripetal force ($\frac{mv^2}{l}$) is provided by tension, so the net force will be equal to tension i.e., T .

130. A particle executes linear simple harmonic motion with an amplitude of 3 cm . When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then its time period in seconds is:

(1) $\frac{\sqrt{5}}{2\pi}$

(2) $\frac{4\pi}{\sqrt{5}}$

(3) $\frac{2\pi}{\sqrt{3}}$

(4) $\frac{\sqrt{5}}{\pi}$

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	$\frac{4\pi}{\sqrt{5}}$	Medium	Oscillation

Sol. $v = \omega\sqrt{A^2 - x^2}$ and $a = x\omega^2$

According to the question,

$$v = a \text{ i.e., } \omega\sqrt{A^2 - x^2} = x\omega^2 \text{ or, } \sqrt{(3)^2 - (2)^2} = 2 \left(\frac{2\pi}{T} \right)$$

$$\sqrt{5} = \frac{4\pi}{T}$$

$$T = \frac{4\pi}{\sqrt{5}}$$

134. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is:

(1) 1

(2) 4

(3) 0.5

(4) 2

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	4	Medium	Modern Physics

Sol. For last Balmer series

$$\frac{1}{\lambda_b} = R \left[\frac{1}{2^2} - \frac{1}{\infty^2} \right]$$

$$\lambda_b = \frac{4}{R}$$

For last Lyman series

$$\frac{1}{\lambda_l} = R \left[\frac{1}{1^2} - \frac{1}{\infty^2} \right]$$

$$\lambda_l = \frac{1}{R}$$

$$\frac{\lambda_b}{\lambda_l} = \frac{\frac{4}{R}}{\frac{1}{R}}$$

$$\frac{\lambda_b}{\lambda_l} = 4$$

135. Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two will:

(1) move towards each other.

(2) move away from each other.

(3) will become stationary.

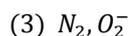
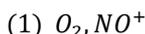
(4) Keep floating at the same distance between them.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	move towards each other.	Easy	Gravitation

Sol. Both the astronauts are in the condition of weightlessness. Gravitational force between them pulls towards each other.

SUBJECT – 3: CHEMISTRY

136. Which one of the following pairs of species have the same bond order?



Answer Key	Answer	Difficulty Level	Chapter Name
(2)	CN^-, CO	Medium	Chemical Bonding and molecular structure

Sol. $O_2: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma 2p_z^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \pi^* 2p_x^1 \equiv \pi^* 2p_y^1$

$$\text{Bond order} = \frac{1}{2}(N_b - N_a) = \frac{1}{2}(10 - 6) = 2$$

$NO^+: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2$

$$\text{Bond order} = \frac{1}{2}(10 - 4) = 3$$

$CN^-: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2$

$$\text{Bond order} = \frac{1}{2} \times (10 - 4) = 3$$

$CO: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2$

$$\text{Bond order} = \frac{1}{2}(10 - 4) = 3$$

$N_2: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2$

$$\text{Bond order} = \frac{1}{2} \times (10 - 4) = 3$$

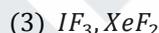
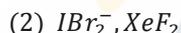
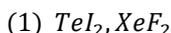
$O_2^-: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2 \pi^* 2p_x^2 \equiv \pi^* 2p_y^1$

$$\text{Bond order} = \frac{1}{2}(10 - 7) = 1.5$$

$NO: \sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p_x^2 \equiv \pi 2p_y^2 \sigma 2p_z^2 \pi^* 2p_x^1$

$$\text{Bond order} = \frac{1}{2}(10 - 5) = 2.5$$

137. Which of the following pairs of compounds is isoelectronic and isostructural?



Answer Key	Answer	Difficulty Level	Chapter Name
(2)	IBr_2^-, XeF_2	Medium	Chemical Bonding and molecular structure

Sol.	Compound	Structure
	TeI_2	Bent
	XeF_2	Linear
	IBr_2^-	Linear
	IF_3	T-Shaped
	$BeCl_2$	Linear

Only XeF_2 & IBr_2^- have same number of valence electrons.

138. Which is the incorrect statement?

(1) Density decreases in case of crystals with Schottky's defect.

(2) $NaCl(s)$ is insulator, silicon is semiconductor, silver is conductor, quartz is piezo electric crystal.

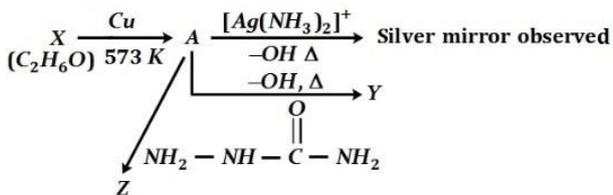
(3) Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal

(4) $FeO_{0.98}$ has non stoichiometric metal deficiency defect.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal	Medium	Solid State

Sol. Frenkel defect is shown by ionic compounds in which the smaller ion is dislocated from its normal site to an interstitial site.

139. Consider the reaction.

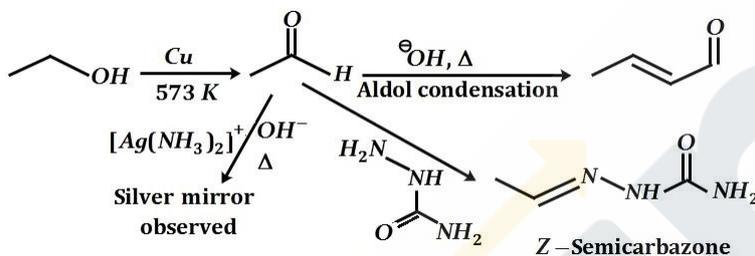


Identify A, X, Y and Z.

- (1) A –Methoxymethane, X –Ethanol, Y – Ethanoic acid, Z –Semicarbazide.
- (2) A –Ethanal, X –Ethanol, Y –But-2-enal, Z –Semicarbanzone.
- (3) A –Ethanol, X –Acetaldehyde, Y –Butanone, Z –Hydrazone.
- (4) A –Methoxymethane, X –Ethanoic acid, Y –Acetate ion, Z –Hydrazine.

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	A –Ethanal, X –Ethanol, Y –But-2-enal, Z –Semicarbanzone.	Medium	Aldehydes, ketones and carboxylic acids

Soln:



140. The element Z = 114 has been discovered recently. It will belong to which of the following family/group and electronic configuration?

- (1) Carbon family, [Rn] 5f¹⁴ 6d¹⁰ 7s² 7p²
- (2) Oxygen family, [Rn] 5f¹⁴ 6d¹⁰ 7s² 7p⁴
- (3) Nitrogen family, [Rn] 5f¹⁴ 6d¹⁰ 7s² 7p⁶
- (4) Halogen family, [Rn] 5f¹⁴ 6d¹⁰ 7s² 7p⁵

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Carbon family, [Rn] 5f ¹⁴ 6d ¹⁰ 7s ² 7p ²	Easy	Classification of elements and periodicity in properties

Sol. Electronic configuration of element Z = 114 is [Rn]5f¹⁴ 6d¹⁰ 7s² 7p². The element belongs to carbon family.

141. In the electrochemical cell:

Zn|ZnSO₄(0.01 M)||CuSO₄(1.0 M)|Cu, the emf of this Daniel cell is E₁. When the concentration of ZnSO₄ is changed to 0.01 M and that of CuSO₄ changed to 0.01 M, the emf changes to E₂. From the followings, which one is the relationship between E₁ and E₂? (Given, $\frac{RT}{F} = 0.059$)

- (1) E₁ < E₂
- (2) E₁ > E₂
- (3) E₂ = 0 ≠ E₁
- (4) E₁ = E₂

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	E ₁ > E ₂	Medium	Electrochemistry

Sol. For a cell Zn|ZnSO₄||CuSO₄|Cu

$$\begin{aligned}
 E &= E_{cell}^{\circ} - \frac{2.303 RT}{2F} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} \\
 \therefore E_1 &= E_{cell}^{\circ} - \frac{2.303 RT}{2F} \log \left(\frac{0.01}{1} \right) \\
 \text{and } E_2 &= E_{cell}^{\circ} - \frac{2.303 RT}{2F} \log \left(\frac{1}{0.01} \right) \\
 \therefore E_1 &> E_2
 \end{aligned}$$

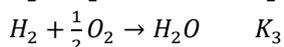
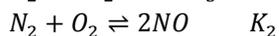
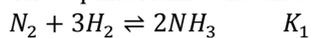
142. The reason for greater range of oxidation states in actinoids is attributed to :

- (1) actinoid contraction
- (2) $5f$, $6d$ and $7s$ levels having comparable energies
- (3) $4f$ and $5d$ levels being close in energies
- (4) the radioactive nature of actinoids

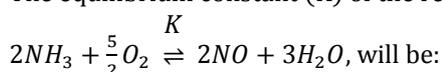
Answer Key	Answer	Difficulty Level	Chapter Name
(2)	$5f$, $6d$ and $7s$ levels having comparable energies	Easy	d and f -block elements

Sol. The greater range of oxidation states in actinoids is due to the fact that the $5f$, $6d$ and $7s$ levels are of comparable energies.

143. The equilibrium constants of the following are:



The equilibrium constant (K) of the reaction:

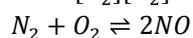


- (1) $K_2K_3^3/K_1$ (2) K_2K_3/K_1 (3) $K_2^3K_3/K_1$ (4) $K_1K_3^3/K_2$

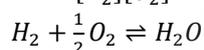
Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$K_2K_3^3/K_1$	Medium	Equilibrium

Sol. $N_2 + 3H_2 \rightleftharpoons 2NH_3$

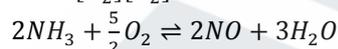
$$K_1 = \frac{[NH_3]^2}{[N_2][H_2]^3}$$



$$K_2 = \frac{[NO]^2}{[N_2][O_2]}$$



$$K_3 = \frac{[H_2O]}{[H_2][O_2]^{\frac{1}{2}}}$$



$$K = \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{\frac{5}{2}}}$$

$$\frac{K_2K_3^3}{K_1} = \frac{\left(\frac{[NO]^2}{[N_2][O_2]} \right)^2 \times \left(\frac{[H_2O]}{[H_2][O_2]^{\frac{1}{2}}} \right)^3}{\frac{[NH_3]^2}{[N_2][H_2]^3}}$$

$$= \frac{[NO]^2[H_2O]^3[N_2][H_2]^3}{[H_2]^3[O_2]^{\frac{5}{2}}[N_2][NH_3]^2}$$

$$= \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{\frac{5}{2}}}$$

$$= \frac{[NO]^2[H_2O]^3}{[NH_3]^2[O_2]^{\frac{5}{2}}}$$

$$\frac{K_2K_3^3}{K_1} = K$$

144. It is because of inability of ns^2 electrons of the valence shell to participate in bonding that:

- (1) Sn^{2+} is oxidising while Pb^{4+} is reducing
- (2) Sn^{2+} and Pb^{2+} are both oxidising and reducing
- (3) Sn^{4+} is reducing while Pb^{4+} is oxidising
- (4) Sn^{2+} is reducing while Pb^{4+} is oxidising

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Sn^{2+} is reducing while Pb^{4+} is oxidising	Medium	p-block elements I

Sol. Inability of ns^2 electrons of the valence shell to participate in bonding on moving down the group in heavier p-block elements is called inert pair effect. Pb is below Sn in group 14.

Stability order in $Pb^{2+} > Pb^{4+}$ and $Sn^{4+} > Sn^{2+}$.

Pb^{4+} can be easily reduced to Pb^{2+} and is an oxidising agent

Sn^{2+} can be easily oxidized to Sn^{4+} and is a reducing agent.

145. Correct increasing order for the wavelengths of absorption in the visible region for the complexes of Co^{3+} is :

- (1) $[Co(H_2O)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$
- (2) $[Co(H_2O)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$
- (3) $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(H_2O)_6]^{3+}$
- (4) $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	Frenkel defect is favoured in those ionic compounds in which sizes of cation and anions are almost equal	Medium	Coordination Compounds

Sol. The order of the ligand in the spectrochemical series is $H_2O < NH_3 < en$.

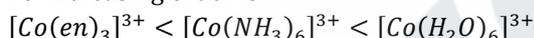
The order of energy absorbed will be:



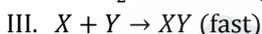
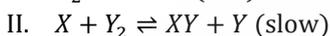
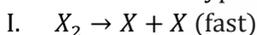
Hence, the order of wavelength of light absorbed will be:



i.e. increasing order is



146. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2XY$ is given below:



The overall order of the reaction will be:

(1) 2

(2) 0

(3) 1.5

(4) 1

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	1.5	Medium	Chemical Kinetics

Sol. Overall rate = rate of determining step (slowest step) = $k[X][Y_2]$ (1)

For step I;

$$K_{eq} = \frac{[X]^2}{[X_2]}$$

$$\therefore [X] = \sqrt{K_{eq}} [X_2]^{\frac{1}{2}} \dots\dots\dots (2)$$

From equations (1) and (2);

$$\text{Rate} = k\sqrt{K_{eq}} [X_2]^{\frac{1}{2}} [Y_2]$$

$$\text{Rate} = K' [X_2]^{\frac{1}{2}} [Y_2]$$

$$\text{Order} = 1 + 0.5 = 1.5$$

147. Which one of the following statements is not correct?

- (1) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.
- (2) Enzymes catalyse mainly bio-chemical reactions.
- (3) Coenzymes increase the catalytic activity of enzyme.
- (4) Catalyst does not initiate any reaction.

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.	Easy	Chemical Kinetics

Sol. The equilibrium constant is not effected by the presence of catalyst at a given temperature.

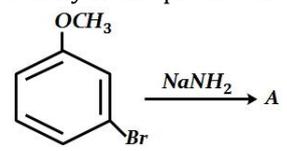
148. An example of a sigma bonded organometallic compounds is:

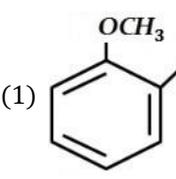
- (1) Grignard's reagent
- (2) Ferrocene
- (3) Cobaltocene
- (4) Ruthenocene

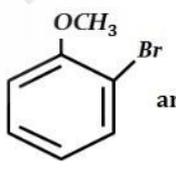
Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Grignard's reagent	Easy	Halogen derivatives of Alkanes and Arenes

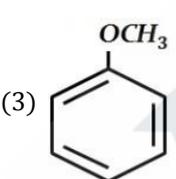
Sol. Grignard's reagent is a sigma bonded organometallic compound. Grignard's reagent is $R - Mg - X$ where R is an alkyl/aryl group and X is halogen.

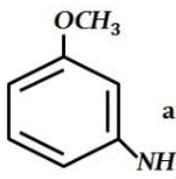
149. Identify A and predict the type of reaction

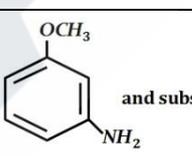


(1)  and elimination addition reaction

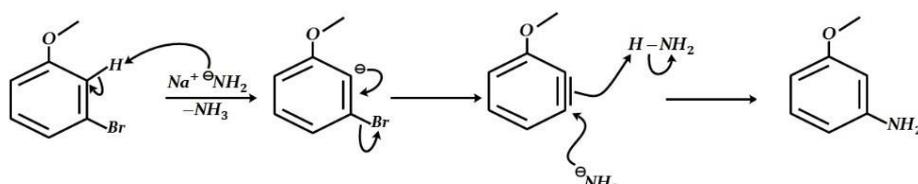
(2)  and cine substitution reaction

(3)  and cine substitution reaction

(4)  and substitution reaction

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	 and substitution reaction	Medium	Haloalkanes and haloarenes

Sol.



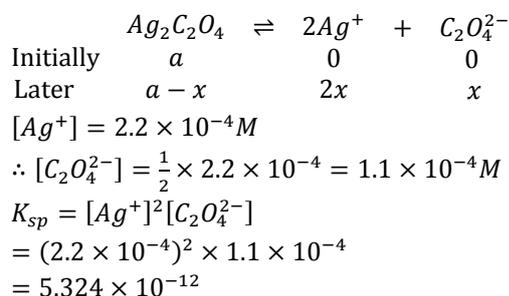
$\ominus NH_2$ will not attack at ortho position on benzyne because the electron density at ortho position is more as compared to meta position due the presence of electron donating group $-OCH_3$. It is a substitution reaction as $-NH_2$ group replaces $-Br$.

150. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is $2.2 \times 10^{-4} \text{ mol L}^{-1}$. Solubility product of $Ag_2C_2O_4$ is:

- (1) 2.66×10^{-12} (2) 4.5×10^{-11} (3) 5.3×10^{-12} (4) 2.42×10^{-8}

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	5.3×10^{-12}	Medium	Equilibrium

Sol.

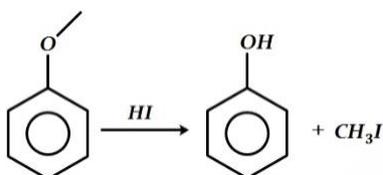


151. The heating of phenyl-methyl ethers with HI produces.

- (1) Iodobenzene (2) Phenol
 (3) Benzene (4) Ethyl chlorides

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	Phenol	Easy	Alcohols, phenols and Ethers

Sol.



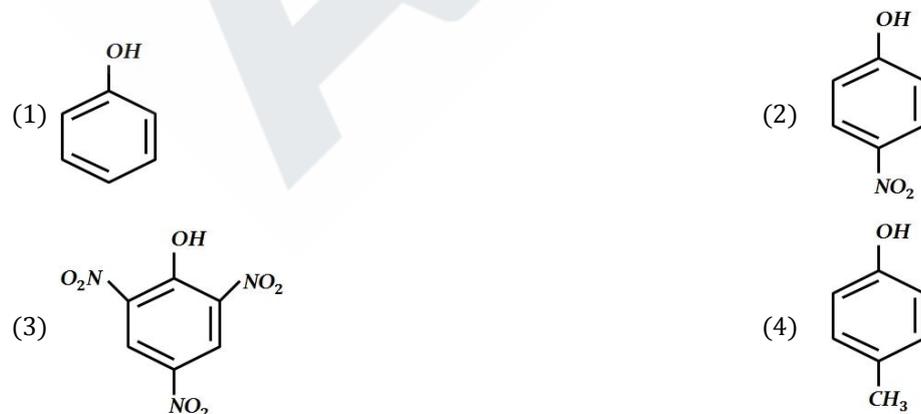
152. The most suitable method of separation of 1: 1 mixture of ortho and para-nitrophenols is:

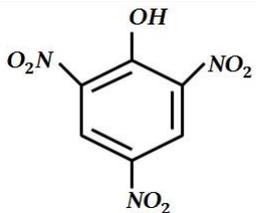
- (1) Chromatography (2) Crystallization
 (3) Steam distillation (4) Sublimation

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Steam distillation	Medium	Organic Chemistry - Some basic principles and techniques

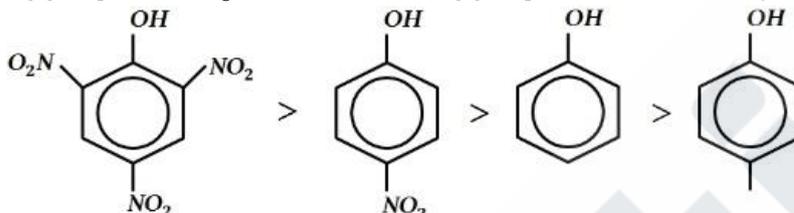
Sol. *o*-nitrophenol undergoes intramolecular *H*-bonding while *p*-nitrophenol undergoes intermolecular *H* –bonding. Thus, *o*-nitrophenol is more volatile than *p*-nitrophenol and steam distillation can be used to separate them.

153. Which one is the most acidic compound?



Answer Key	Answer	Difficulty Level	Chapter Name
(3)		Medium	Alcohols, phenols and Ethers

Sol. Greater the number of electron withdrawing groups at ortho and para positions on phenol, greater is its acidity. Greater the number of electron donating groups at ortho and para positions on phenol, lesser is its acidity. NO_2 is electron withdrawing group while CH_3 is electron donating group. The order of acidity of the given compounds is



154. A first order reaction has a specific reaction rate of 10^{-2}sec^{-1} . How much time will it take for 20 g of the reactant to reduce to 5 g?

- (1) 138.6 sec (2) 346.5 sec (3) 693.0 sec (4) 238.6 sec

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	138.6 sec	Medium	Chemical Kinetics

Sol. Given that specific reaction rate = rate constant (k) = 10^{-2}s^{-1}
 20 g of reactant is reduced to 5 g implies that the total duration is equal to 2 half lives, i.e., 1 half life from 20 g to 10 g and 2nd half life from 10 g to 5 g.

$$\begin{aligned} \text{Thus, total time} &= 2 t_{1/2} \\ &= 2 \times \frac{0.693}{k} = 2 \times \frac{0.693}{10^{-2}} \\ &= 1.386 \times 10^2 \text{ s} = 138.6 \text{ s} \end{aligned}$$

155. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be :

- (1) -500 J (2) -505 J (3) +505 J (4) 1136.25 J

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	-505 J	Medium	Thermodynamics

Sol. $P = 5 \text{ atm} = 5 \times 1.01 \times 10^5 \text{ Pa}$
 $V_1 = 2.5 \text{ L} = 2.5 \times 10^{-3} \text{ m}^3, V_2 = 4.5 \text{ L} = 4.5 \times 10^{-3} \text{ m}^3$
 We know that;
 $\Delta U = Q + W$
 From an insulated system, $Q = 0$
 $\therefore \Delta U = W$
 $= -P\Delta V$
 $\therefore \Delta U = -2.5 \times 1.01 \times 10^5 \times (4.5 - 2.5) \times 10^{-3}$
 $= -5.05 \times 10^2$
 $\therefore \Delta U = -505 \text{ J}$

156. Which of the following is dependent on temperature?

- (1) Molarity (2) Mole fraction
 (3) Weight percentage (4) Molality

161. For a given reaction, $\Delta H = 35.5 \text{ kJ mol}^{-1}$ and $\Delta S = 83.6 \text{ JK}^{-1} \text{ mol}^{-1}$. The reaction is spontaneous at: (assume that ΔH and ΔS do not vary with temperature.)

- (1) $T > 425 \text{ K}$ (2) All temperatures
 (3) $T > 298 \text{ K}$ (4) $T < 425 \text{ K}$

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$T > 425 \text{ K}$	Medium	Thermodynamics

Sol. For a spontaneous reaction:

$$\Delta G < 0$$

We know that

$$\Delta G = \Delta H - T\Delta S$$

$$\therefore \Delta H - T\Delta S < 0 \text{ for spontaneous reaction}$$

$$\therefore \Delta H - T\Delta S < 0$$

$$\therefore \Delta H < T\Delta S$$

$$\therefore T > \frac{\Delta H}{\Delta S}$$

$$\therefore T > \frac{35.5 \times 10^3}{83.6}$$

$$\therefore T > 425 \text{ K}$$

162. Which one is the correct order of acidity?

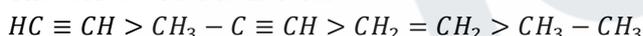
- (1) $\text{CH} \equiv \text{CH} > \text{CH}_3 - \text{C} \equiv \text{CH} > \text{CH}_2 = \text{CH}_2 > \text{CH}_3 - \text{CH}_3$
 (2) $\text{CH} \equiv \text{CH} > \text{CH}_2 = \text{CH}_2 > \text{CH}_3 - \text{C} \equiv \text{CH} > \text{CH}_3 - \text{CH}_3$
 (3) $\text{CH}_3 - \text{CH}_3 > \text{CH}_2 = \text{CH}_2 > \text{CH}_3 - \text{C} \equiv \text{CH} > \text{CH} \equiv \text{CH}$
 (4) $\text{CH}_2 = \text{CH}_2 > \text{CH}_3 - \text{CH} = \text{CH}_2 > \text{CH}_3 - \text{C} \equiv \text{CH} > \text{CH} \equiv \text{CH}$

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$\text{CH} \equiv \text{CH} > \text{CH}_3 - \text{C} \equiv \text{CH} > \text{CH}_2 = \text{CH}_2 > \text{CH}_3 - \text{CH}_3$	Easy	Hydrocarbons

Sol. The general order of acidity is

Alkynes > Alkenes > Alkanes

The correct order is therefore

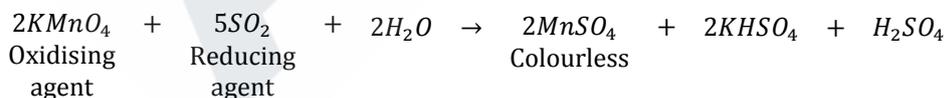


163. Name the gas that can readily decolourise acidified KMnO_4 solution:

- (1) SO_2 (2) NO_2 (3) P_2O_5 (4) CO_2

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	SO_2	Easy	d and f-block elements

Sol.



164. Which of the following statements is not correct?

- (1) Ovalbumin is a simple food reserve in egg-white.
 (2) Blood proteins thrombin and fibrinogen are involved in blood clotting.
 (3) Denaturation makes the proteins more active.
 (4) Insulin maintains sugar level in the blood of a human body.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Denaturation makes the proteins more active.	Easy	Biomolecules

Sol. The uncoiling and unfolding of proteins leads to change in its three-dimensional structure. As a result, the protein loses its biological activity. Its biological activity is associated with the three-dimensional structure of protein.

165. If molality of the dilute solution is doubled, the value of molal depression constant (K_f) will be:

- (1) Halved (2) Tripled (3) Unchanged (4) Doubled

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Unchanged	Easy	Solutions

Sol. Molal depression constant is independent of the concentration of solution. It depends only on the type of solvent, i.e., molecular mass, freezing point and latent heat of fusion of solvent.

166. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field?

- (1) *K* (2) *Rb* (3) *Li* (4) *Na*

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	<i>Li</i>	Medium	s-block elements

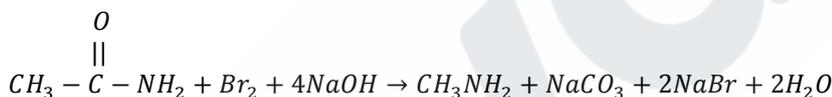
Sol. Greater the size of the hydrated ion, lesser is its ionic mobility. Here, the lowest size is of Li^+ ion. Thus, it will be heavily hydrated among all the alkali metal ions. Hence, effective size of Li^+ ion in aqueous solution will be the largest. As a result, Li^+ has the lowest ionic mobility in aqueous solution.

167. Which of the following reactions is appropriate for converting acetamide to methanamine?

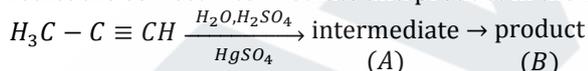
- (1) Hoffmann hypobromamide reaction (2) Stephens reaction
(3) Gabriels phthalimide synthesis (4) Carbylamines reaction

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	Hoffmann hypobromamide reaction	Easy	Amines

Sol. Hoffmann bromamide reaction for acetamide is



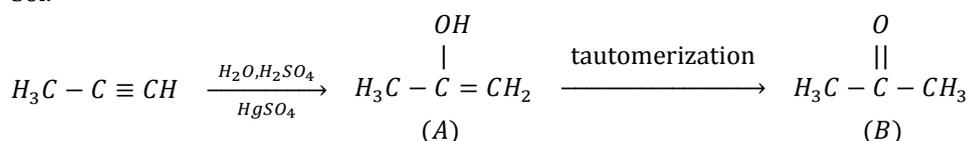
168. Predict the correct intermediate and product in the following reaction:



- (1) **A:** $H_3C - \overset{OH}{\mid} C = CH_2$ **B:** $H_3C - \overset{SO_4}{\mid} C = CH_2$ **A:** $H_3C - C - CH_3$ **B:** $H_3C - C \equiv CH$
- (2) **A:** $H_3C - \overset{O}{\parallel} C = CH_2$ **B:** $H_3C - C - CH_3$
- (3) **A:** $H_3C - \overset{OH}{\mid} C = CH_2$ **B:** $H_3C - \overset{\parallel}{O} C - CH_3$ **A:** $H_3C - \overset{\parallel}{O} C = CH_2$ **B:** $H_3C - \overset{\parallel}{O} C - CH_3$
- (4) **A:** $H_3C - \overset{\parallel}{O} C = CH_2$ **B:** $H_3C - \overset{\parallel}{O} C - CH_3$

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	A: $H_3C - \overset{OH}{\mid} C = CH_2$ B: $H_3C - \overset{\parallel}{O} C - CH_3$	Easy	Hydrocarbons

Sol.

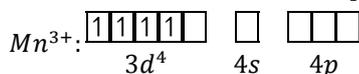


169. Pick out the correct statement with respect to $[Mn(CN)_6]^{3-}$:

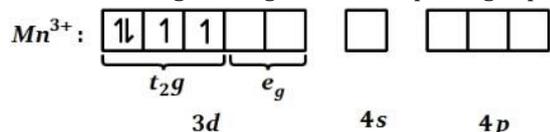
- (1) It is sp^3d^2 hybridised and tetrahedral
 (2) It is d^2sp^3 hybridised and octahedral
 (3) It is dsp^2 hybridised and square planar
 (4) It is sp^3d^2 hybridised and octahedral

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	It is d^2sp^3 hybridised and octahedral	Medium	Coordination Compounds

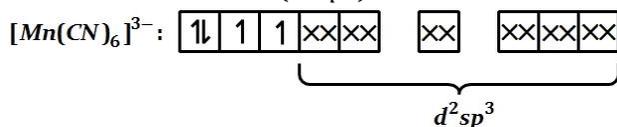
Sol. Oxidation state of Mn in $[Mn(CN)_6]^{3-}$ is +3. Here, coordination number is 6



CN^- is a strong field ligand. Hence, pairing is possible.



Structure = octahedral (d^2sp^3)



170. Match the interhalogen compounds of column I with the geometry in column II and assign the correct code.

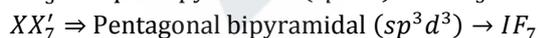
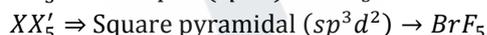
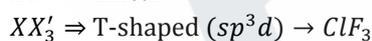
Column - I	Column - II
P. XX'	I. T-shape
Q. XX'_3	II. Pentagonal bipyramidal
R. XX'_5	III. Linear
S. XX'_7	IV. Square-pyramidal
	V. Tetrahedral

Code:

	P.	Q.	R.	S.
(1)	III	I	IV	II
(2)	V	IV	III	II
(3)	IV	III	II	I
(4)	III	IV	I	II

Answer Key	Answer	Difficulty Level	Chapter Name
(1)	P - III, Q - I, R - IV, S - II	Medium	p-block elements II

Sol. $XX' \Rightarrow$ Linear

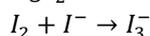
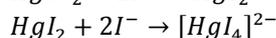


171. $HgCl_2$ and I_2 both when dissolved in water containing I^- ions the pair of species formed is:

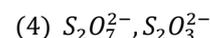
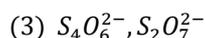
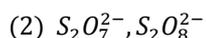
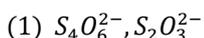
- (1) HgI_2, I^- (2) HgI_4^{2-}, I_3^- (3) Hg_2I_2, I^- (4) HgI_2, I_3^-

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	HgI_4^{2-}, I_3^-	Medium	d and f-block elements

Sol. $HgCl_2 + 2I^- \rightarrow HgI_2 + 2Cl^-$

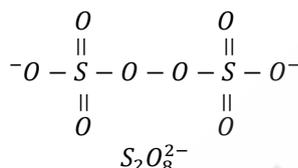
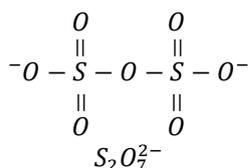
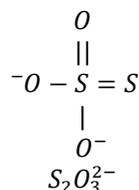
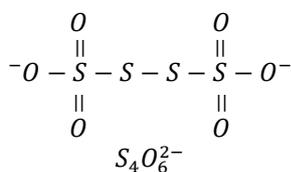


172. In which pair of ions both the species contain S – S bond?



Answer Key	Answer	Difficulty Level	Chapter Name
(1)	$S_4O_6^{2-}, S_2O_3^{2-}$	Medium	p-block elements II

Sol.



173. The IUPAC name of the compound



(1) 5-formylhex-2-en-3-one

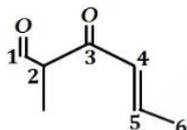
(2) 5-methyl-4-oxohex-2-en-5-al

(3) 3-keto-2-methylhex-5-enal

(4) 3-keto-2-methylhex-4-enal

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	3-keto-2-methylhex-4-enal	Medium	Aldehydes, ketones and carboxylic acids

Sol.



3-keto-2-methylhex-4-enal

174. Which one is the wrong statement?

(1) The uncertainty principle is $\Delta E \times \Delta t \geq \frac{h}{4\pi}$.

(2) Half filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement.

(3) The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.

(4) de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$, where m = mass of the particle, v = group velocity of the particle.

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	The energy of 2s orbital is less than the energy of 2p orbital in case of Hydrogen like atoms.	Easy	Structure of atom

Sol. The energy of an electron in unielectron atoms (hydrogen like atoms) is determined solely by the principle quantum number. Thus, the orbitals with same principal quantum number have same energy. Hence, energy of 2s orbital is equal to 2p orbital for hydrogen like atoms.

175. With respect to the conformers of ethane, which of the following statements is true?

- (1) Bond angle changes but bond length remains same
- (2) Both bond angle and bond length change
- (3) Both bond angles and bond length remains same
- (4) Bond angle remains same but bond length changes

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Both bond angles and bond length remains same	Easy	Hydrocarbons

Sol. The conformers of ethane differ only in their dihedral angle. There is no difference in the bond angles and bond lengths of the conformers of ethane molecule.

176. A 20 litre container at 400 K contains $CO_2(g)$ at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be:

(Given that: $SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$, $K_p = 1.6$ atm)

- (1) 10 litre
- (2) 4 litre
- (3) 2 litre
- (4) 5 litre

Answer Key	Answer	Difficulty Level	Chapter Name
(4)	5 litre	Hard	Equilibrium

Sol. $SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$

$$K_p = P_{CO_2} = 1.6 \text{ atm}$$

Maximum pressure of CO_2 = Pressure at equilibrium

$$\therefore P_{max} = 1.6 \text{ atm}$$

Initially $P_1 = 0.4 \text{ atm}$, $V_1 = 20 \text{ L}$

$$\therefore P_1 V_1 = P_{max} V_{max}$$

$$\therefore V_{max} = \frac{P_1 V_1}{P_{max}} = \frac{0.4 \times 20}{1.6}$$

$$V_{max} = 5 \text{ L}$$

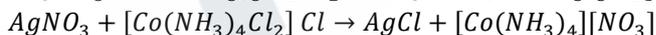
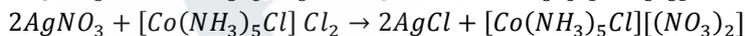
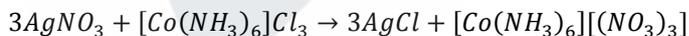
177. The correct order of the stoichiometries of $AgCl$ formed when $AgNO_3$ in excess is treated with the complexes: $CoCl_3 \cdot 6NH_3$, $CoCl_3 \cdot 5NH_3$, $CoCl_3 \cdot 4NH_3$ respectively is:

- (1) $3AgCl$, $1AgCl$, $2AgCl$
- (2) $3AgCl$, $2AgCl$, $1AgCl$
- (3) $2AgCl$, $3AgCl$, $1AgCl$
- (4) $1AgCl$, $3AgCl$, $2AgCl$

Answer Key	Answer	Difficulty Level	Chapter Name
(2)	$3AgCl$, $2AgCl$, $1AgCl$	Medium	Coordination Compounds

Sol. The complexes are $[Co(NH_3)_6]Cl_3$, $[Co(NH_3)_5Cl]Cl_2$, $[Co(NH_3)_4Cl_2]Cl$

The reactions are

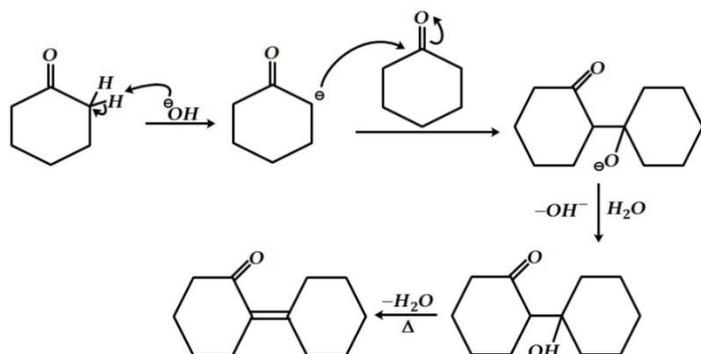


178. Of the following, which is the product formed when cyclohexanone undergoes aldol condensation followed by heating?



Answer Key	Answer	Difficulty Level	Chapter Name
(1)		Medium	Aldehydes, ketones and carboxylic acids

Sol.



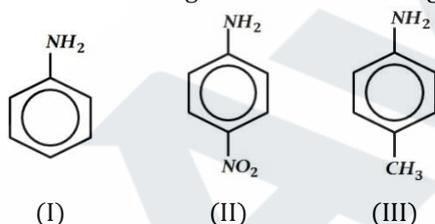
179. The correct statement regarding electrophile is:

- (1) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile
- (2) Electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile
- (3) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile
- (4) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile	Easy	Organic Chemistry - Some basic principles and techniques

Sol. Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile.

180. The correct increasing order of basic strength for the following compounds is:



- (1) III < I < II (2) III < II < I (3) II < I < III (4) II < III < I

Answer Key	Answer	Difficulty Level	Chapter Name
(3)	II < I < III	Medium	Amines

Sol. Greater the number of electron donating groups at ortho and para positions of aniline, greater is its basic strength. Greater the number of electrons withdrawing groups at ortho and para position of aniline, lesser is its basic strength.

NO_2 is an electron withdrawing groups while CH_3 is an electron donating group.

The order of basic strength is

