Test Booklet Code

GG

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 is 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 handover the Answer Sheet to the invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.**
6. The CODE for this Booklet is **GG**. 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 Booklets and the Answer Sheets.
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 Admission 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 the 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 Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.
14. No part of the Test Booklet and Answer Sheet shall be detached under any 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): _____

Roll Number : in figure _____

: in words _____

Centre of Examination (in Capitals): _____

Candidate's Signature : _____ Invigilator's Signature _____

Fascimile signature stamp of Centre superintendent _____

1. Offsets are produced by

(1) Parthenocarpy (2) Parthenogenesis (3) Mitotic divisions (4) Meiotic divisions

Sol: [3]

2. The experimental proof for semiconservative replication of DNA was first shown in a

(1) Plant (2) Virus (3) Bacterium (4) Fungus

Sol: [1]

3. Select the *correct* match

(1) Matthew Meselson – Pisum'sativun and F. Stahl

(2) Francois Jacob and Jacques Monod – Lac operon

(3) Alfred Hershey and Martha Chase – TMV

(4) Alec Jeffreys – Streptococcus pneumonia

Sol: [2]

4. Which of the following pairs is **wrongly** matched ?

(1) XO type sex Determination : Grasshopper

(2) T.H. Morgan : Linkage

(3) ABO blood grouping : Co-dominance

(4) Starch synthesis in pea : Multiple alleles

Sol: [4]

5. Select the **correct** statement

(1) Spliceosomes take part in translation

(2) Transduction was discovered by S. Altman.

(3) Punnett square was developed by a British scientist

(4) Franklin stah1 coined the term "linkage".

Sol: [3]

6. Which of the following has proved helpful in preserving pollen as fossils ?

(1) Oil content (2) Sporopollenin (3) Cellulosic intine (4) Pollenkitt

Sol: [2]

7. Which of the following flowers only once in its life-time ?

(1) Mango (2) Papaya (3) Jackfruit (4) Bamboo species

Sol: [4]

8. The correct order of steps in Polymerase Chain Reaction (PCR) is

(1) Denaturation, Extension, Annealing (2) Denaturation, Annealing, Extension

(3) Annealing, Extension, Denaturation (4) Extension, Denaturation, Annealing

Sol: [2]

9. In India, the organisation responsible for assessing the safety of introducing genetically modified organisms for public use is

(1) Research Committee on Genetic Manipulation (RCGM)

(2) Genetic Engineering Appraisal Committee (GEAC)

(3) Council for Scientific and Industrial Research (CSIR)

(4) Indian Council of Medical Research (ICMR)

Sol: [2]

10. Which of the following is commonly used as a vector for introducing a DNA fragment in human lymphocytes?

(1) λ phase (2) pBR 322 (3) Ti plasmid (4) Retrovirus

Sol: [4]

11. Use of bioresources by multinational companies and organisations without authorisation from the concerned country and its people is called

(1) Biodegradation (2) Bioexploitation (3) Biopiracy (4) Bio-infringement

Sol: [3]

12. A 'new' variety of rice was patented by a foreign company, though such varieties have been present in India for a long time. This is related to

(1) Lerma Rajo (2) Basmati (3) Sharbati Sonora (4) Co-667

Sol: [2]

13. Select the ***correct*** match

(1) T.H. Morgan – Transduction (2) G. Mendel – Transformation

(3) F_2 × Recessive parent – Dihybrid cross (4) Ribozyme – Nucleic acid

Sol: [4]

14. Which of the following is true for nucleolus ?

(1) It takes part in spindle formation.

(2) It is a site for active, ribosomal RNA synthesis.

(3) It is a membrane-bound structure.

(4) Larger nucleoli are present in dividing cells,

Sol: [2]

15. The Golgi complex participates in

(1) Respiration in bacteria (2) Activation of amino acid

(3) Formation of secretory vesicles (4) Fatty acid breakdown

Sol: [3]

16. Which of the following is **not** a product of light reaction of photosynthesis ?

(1) NADPH (2) Oxygen (3) NADH (4) ATP

Sol: [3]

17. Which among the following is **not** a prokaryote ?

(1) Nostoc (2) Oscillatoria (3) Mycobacterium (4) Saccharomyces

Sol: [4]

18. Stomatal movement is not affected by

(1) O_2 concentration (2) CO_2 concentration (3) Light (4) Temperature

Sol: [1]

19. The two functional groups characteristic of sugars are

(1) carbonyl and phosphate (2) carbonyl and hydroxyl

(3) carbonyl and methyl (4) hydroxyl and methyl

Sol: [2]

20. The stage during which separation of the paired homologous chromosomes begins is

(1) Diakinesis (2) Zygotene (3) Diplotene (4) Pachytene

Sol: [3]

21. Stomata in grass leaf are

(1) Rectangular (2) Barrel shaped (3) Kidney shaped (4) Dumb-bell shaped

Sol: [4]

22. Which one is **wrongly** matched ?

(1) Gemma cups - Marchantia (2) Unicellular organism - Chlorella

(3) Biflagellate zoospores - Brown algae (4) Uniflagellate gametes - Polysiphonia

Sol: [4]

23. Match the items given in Column I with those in Column I1 and select the **correct** option given below:

	Column I		Column II
a.	Herbarium	i.	It is a place having a collection of preserved plants and animals.
b.	Key	ii.	A list that enumerates methodically all the species found in an area with brief description aiding identification.
c.	Museum	iii.	Is a place where dried and pressed plant specimens mounted on sheets are kept.
d.	Catalogue	iv.	A booklet containing a list of characters and their alternates which are helpful in identification of various taxa.

	a	b	c	d
(1)	ii	iv	iii	i
(2)	iii	iv	i	ii
(3)	iii	ii	i	iv
(4)	i	iv	iii	ii

Sol: [2]

24. Winged pollen grains are present in

(1) Mango (2) *Pinus* (3) *Cycas* (4) Mustard

Sol: [2]

25. After karyogamy followed by meiosis, spores are produced exogenously in

(1) *Agaricus* (2) *Saccharomyces* (3) *Alternaria* (4) *Neurospora*

Sol: [1]

26. Oxygen is **not** produced during photosynthesis by

(1) *Cycas* (2) *Chara*

(3) *Nostoc* (4) Green sulphur bacteria

Sol: [4]

27. Double fertilization is

(1) Fusion of two male gametes with one egg

(2) Syngamy and triple fusion

(3) Fusion of one male gamete with two polar nuclei

(4) Fusion of two male gametes of a pollen tube with two different eggs

Sol: [2]

28. Which of the following elements is responsible for maintaining turgor in cells ?

(1) Potassium (2) Calcium (3) Sodium (4) Magnesium

Sol: [1]

29. Which one of the following plants shows a very close relationship with a species of moth, where none of the two can complete its life cycle without the other ?

(1) *Banana* (2) *Viola* (3) *Yucca* (4) *Hydrilla*

Sol: [3]

30. Pollen grains can be stored for several years in liquid nitrogen having a temperature of

(1) – 196°C (2) – 160° (3) – 80° (4) – 120°

Sol: [1]

31. What is the role of NAD^+ in cellular respiration ?

(1) It is a nucleotide source for ATP synthesis.

(2) It is the final electron acceptor for anaerobic respiration.

(3) It functions as an electron carrier.

(4) It functions as an enzyme.

Sol: [3]

32. In which of the following forms is iron absorbed by plants ?

(1) Free element (2) Both ferric and ferrous

(3) Ferrous (4) Ferric

Sol: [4]

33. Niche is

(1) the range of temperature that the organism needs to live

(2) the functional role played by the organism where it lives

(3) the physical space where an organism lives

(4) all the biological factors in the organism's environment

Sol: [2]

34. Which of the following is a secondary pollutant ?

(1) SO_2 (2) O_3 (3) CO_2 (4) CO

Sol: [2]

35. Natality refers to

(1) Number of individuals leaving the habitat

(2) Number of individuals entering a habitat

(3) Birth rate

(4) Death rate

Sol: [3]

36. World Ozone Day is celebrated on

(1) 16th September (2) 22nd April (3) 21st April (4) 5th June

Sol: [1]

37. What type of ecological pyramid would be obtained with the following data ?

Secondary consumer : 120 g

Primary consumer : 60 g

Primary producer : 10

(1) Upright pyramid of numbers (2) Upright pyramid of biomass

(3) Pyramid of energy (4) Inverted pyramid of biomass

Sol: [4]

38. In stratosphere, which of the following elements acts as a catalyst in degradation of ozone and release of molecular oxygen ?

(1) Fe (2) Oxygen (3) Cl (4) Carbon

Sol: [3]

39. Casparian strips occur in

(1) Cortex (2) Endodermis (3) Pericycle (4) Epidermis

Sol: [2]

40. Plants having little or no secondary growth are

(1) Conifers (2) Cycads

(3) Deciduous angiosperms (4) Grasses

Sol: [4]

41. Pneumatophores occur in

(1) Carnivorous plants (2) Submerged hydrophytes

(3) Free-floating hydrophytes (4) Halophytes

Sol: [4]

42. Sweet potato is a modified

(1) Tap root (2) Rhizome (3) Adventitious root (4) Stem

Sol: [3]

43. Which of the following statements is correct ?

(1) Horsetails are gymnosperms

(2) Stems are usually unbranched in both *Cycas* and *Cedrus*.

(3) *Selaginella* is heterosporous; while *Salvinia* is homosporous.

(4) Ovules are not enclosed by ovary wall in gymnosperms.

Sol: [4]

44. Select the ***wrong*** statement :

(1) Pseudopodia are locomotory and feeding structures in Sporozoans.

(2) Mitochondria are the powerhouse of the cell in all kingdoms except Monera.

(3) Mushrooms belong to Basidiomycetes.

(4) Cell wall is present in members of Fungi and Plantae.

Sol: [1]

45. Secondary xylem and phloem in dicot stem are produced by

(1) Phellogen (2) Axillary meristems

(3) Vascular cambium (4) Apical meristems

Sol: [3]

46. Match the items given in Column I with those in Column II and select the correct option given below :

	Column I		Column II
a.	Glycosuria	i.	Accumulation of uric acid in joints
b.	Gout	ii.	Mass of crystallised salts within,the kidney
c.	Renal calculi	iii.	Inflammation in glomeruli
d.	Glomerular	iv.	Presence of glucose in nephritis urine

	a	b	c	d
(1)	ii	iii	i	iv
(2)	iv	i	ii	iii
(3)	i	ii	iii	iv
(4)	iii	ii	iv	i

Sol: [2]

47. Match the items given in Column I with those in Column I1 and select the correat option given below :

	Column I (Function)		Column 11(Part of Excretory System)
a.	Ultrafiltration	i.	Henle's loop
b.	Concentration of urine	ii.	Ureter
c.	Transport of urine	iii.	Urinary bladder
d.	Storage of urine	iv.	Malpighian corpuscle
		v.	Proximal convoluted tubule

	a	b	c	d
(1)	v	iv	i	ii
(2)	v	iv	i	iii
(3)	iv	i	ii	iii
(4)	iv	v	ii	iii

Sol: [3]

48. Among the following sets of examples for divergent evolution, select the **incorrect** option :

(1) Brain of bat, man and cheetah (2) Eye of octopus, bat and man

(3) Heart of bat, man and cheetah (4) Forelimbs of man, bat and cheetah

Sol: [2]

49. Which of the following is **not** an autoimmune disease ?

(1) Alzheimer's disease (2) Vitiligo

(3) Rheumatoid arthritis (4) Psoriasis

Sol: [1]

50. Which of the following characteristics represent 'Inheritance of blood groups' in humans ?

a. Dominance b. Co-dominance c. Multiple allele

d. Incomplete dominance e. Polygenic inheritance

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

Sol: [3]

51. Conversion of milk to curd improves its nutritional value by increasing the amount of '

(1) Vitamin B_{12} (2) Vitamin E (3) Vitamin A (4) Vitamin D

Sol: [1]

52. The similarity of bone structure in the forelimbs of many vertebrates is an example of

(1) Convergent evolution (2) Adaptive radiation'

(3) Analogy (4) Homology

Sol: [4]

53. In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels ?

(1) Ringworm disease (2) Amoebiasis

(3) Ascariasis (4) Elephantiasis

Sol: [4]

54. Which of the following animals does **not** undergo metamorphosis ?

(1) Moth (2) Starfish (3) Tunicate (4) Earthworm

Sol: [4]

55. Which one of these animals is **not** a homeotherm ?

(1) *Camelus* (2) *Psittacula* (3) *Chelone* (4) *Macropus*

Sol: [3]

56. Which of the following'features is used to identify a male cockroach from a female cockroach?

(1) Forewings with darker tegmina

(2) Presence of anal cerci

(3) Presence of caudal styles.

(4) Presence of a boat shaped sternum on the 9th abdominal segment

Sol: [3]

57. Which of the following organisms are known as chief producers in the oceans ?

(1) Cyanobacteria (2) Euglenoids (3) Diatoms (4) Dinoflagellates

Sol: [3]

58. Ciliates differ from all other protozoans in

(1) using pseudopodia for capturing prey

(2) having two types of nuclei

(3) having a contractile vacuole for removing excess water

(4) using flagella for locomotion

Sol: [2]

59. Identify the vertebrate group of animals characterized by crop and gizzard in its digestive system.

(1) Aves (2) Osteichthyes (3) Reptilia (4) Amphibia

Sol: [1]

60. Hormones secreted by the placenta to maintain pregnancy are

(1) hCG, hPL, progestogens, estrogens

(2) hCG, progestogens, estrogens, glucocorticoids

(3) hCG, hPL, estrogens, relaxin, oxytocin

(4) hCG, hPL, progestogens, prolactin

Sol: [1]

61. The contraceptive 'SAHELI'

(1) is an IUD.

(2) is a post-coital contraceptive.

(3) increases the concentration of estrogen and prevents ovulation in females.

(4) Blocks estrogen receptors in the uterus, preventing eggs from getting implanted

Sol: [4]

62. The amnion of mammalian' embryo is derived from

(1) mesoderm and trophoblast (2) ectoderm and endoderm

(3) endoderm and mesoderm (4) ectoderm and mesoderm

Sol: [4]

63. The difference between spermiogenesis and spermiation is

(1) In spermiogenesis spermatozoa from sertoli cells are released into the cavity of seminiferous tubules, while in spermiation spermatozoa are formed.

(2) In spermiogenesis spermatozoa are formed, while in, spermiation spermatozoa are released from sertoli cells into the cavity of seminiferous tubules.

(3) In spermiogenesis spermatozoa are formed, while in spermiation spermatids are formed.

(4) In spermiogenesis spermatids are formed, while in spermiation spermatozoa are formed.

Sol: [2]

64. In a growing population of a country,

(1) reproductive and pre-reproductive individuals are equal in number.

(2) pre-reproductive individuals are less than the reproductive individuals.

(3) reproductive individuals are less than the post-reproductive individuals.

(4) pre-reproductive individuals are more than the reproductive individuals.

Sol: [4]

65. Which part of poppy plant is used to obtain the drug "Smack" ?

(1) Roots (2) Leaves (3) Latex (4) Flowers

Sol: [3]

66. Match the items given in Column 1 with those in Column 'I1 and select the **correct** option given below :

	Column I		**Column II**
a.	Eutrophication	i.	UV-B radiation
b.	Sanitary landfill	ii.	Deforestation
c.	Snow blindness	iii.	Nutrient enrichment
d.	Jhum cultivation	iv.	Waste disposal

	a	b	c	d
(1)	iii	iv	i	ii
(2)	i	ii	iv	iii
(3)	i	iii	iv	ii
(4)	ii	i	iii	iv

Sol: [1]

67. Which one of the following population interactions is widely used in medical science for the production of antibiotics ?

(1) Parasitism (2) Amensalism (3) Mutualism (4) Commensalism

Sol: [2]

68. All of the following are included in 'Ex-situ conservation' except

(1) Botanical gardens (2) Seed banks (3) Sacred groves (4) Wildlife safari parks

Sol: [3]

69. Which of the following gastric cells indirectly help in erythropoiesis ?

(1) Goblet cells (2) Parietal cells (3) Mucous cells (4) Chief cells

Sol: [2]

70. Match the items given'in Column I with those in Column II and select the **correct** option given below :

	Column I		Column II
a.	Fibrinogen	i.	Osmotic balance
b.	Globulin	ii.	Blood clotting
c.	Albumin	iii.	Defence mechanism

	a	b	c
(1)	i	iii	ii
(2)	ii	iii	i
(3)	i	ii	iii
(4)	iii	ii	i

Sol: [2]

71. Calcium is important in skeletal muscle contraction because it

(1) detaches the myosin head from the actin filament

(2) prevents the formation of bonds between the myosin cross bridges and the actin filament.

(3) activates the myosin ATPase by binding to it.

(4) binds to troponin to remove the masking of active sites on actin for myosin.

Sol: [4]

72. Which of the following is an occupational respiratory disorder ?

(1) Botulism (2) Emphysema (3) Silicosis (4) Anthracis

Sol: [3]

73. Which of the following is an amino acid derived hormone ?

(1) Estradiol (2) Estriol (3) Ecdysone (4) Epinephrine

Sol: [4]

74. Which of the following structures or regions is incorrectly paired with its function ?

(1) Hypothalamus : production of releasing hormones and regulation of temperature, hunger and thirst.

(2) Corpus callosum : band of fibers connecting left and right cerebral hemispheres.

(3) Limbic system : consists of fibre tracts that interconnect different regions of brain; controls movement.

(4) Medulla oblongata : controls respiration and cardiovascular reflexes.

Sol: [3]

75. Which of the following hormones can play a significant role in osteoporosis ?

(1) Estrogen and Parathyroid hormone

(2) Parathyroid hormone and Prolactin

(3) Progesterone and Aldosterone

(4) Aldosterone and Prolactin

Sol: [1]

76. The transparent lens in the human eye is held in its place by

(1) smooth muscles attached to the iris
(2) smooth muscles attached to the ciliary body
(3) ligaments attached to the iris
(4) ligaments attached to the ciliary body

Sol: [4]

77. Which of the following options correctly represents the lung conditions in asthma and emphysema, respectively ?

(1) Increased respiratory surface; Inflammation of bronchioles.
(2) Decreased respiratory surface; Inflammation of bronchioles
(3) Increased number of bronchioles; Increased respiratory surface
(4) Inflammation of bronchioles; Decreased respiratory surface

Sol: [4]

78. Match the items given in Column I with those in Column II and select the **correct** option given below :

	Column I		Column II
a.	Tricuspid valve	i.	Between left atrium and left ventricle
b.	Bicuspid valve	ii.	Between right ventricle and pulmonary artery
c.	Semilunar valve	iii.	Between right atrium and right ventricle

	a	b	c
(1)	i	ii	iii
(2)	ii	i	iii
(3)	i	iii	ii
(4)	iii	i	ii

Sol: [4]

79. Match the items given in Column I with those in Column II and select the **correct** option given below :

	Column I		Column II
a.	Tidal volume	i.	2500 – 3000 mL
b.	Inspiratory Reserve volume	ii.	1100 – 1200 mL
c.	Expiratory Reserve volume	iii.	500 – 550 mL
d.	Residual volume	iv.	1000 – 1100 mL

	a	b	c	d
(1)	i	iv	ii	iii
(2)	iv	iii	ii	i
(3)	iii	i	iv	ii
(4)	iii	ii	i	iv

Sol: [3]

80. Nissl bodies are mainly composed of

(1) Nucleic acids and SER (2) Free ribosomes and RER

(3) DNA and RNA (4) Proteins and lipids

Sol: [2]

81. Which of these statements is **incorrect** ?

(1) Glycolysis operates as long as it is supplied with NAD that can pick up hydrogen atoms.

(2) Oxidative phosphorylation takes place in outer mitochondrial membrane.

(3) Glycolysis occurs in cytosol.

(4) Enzymes of TCA cycle are present in mitochondrial matrix.

Sol: [2]

82. Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such strings of ribosomes are termed as

(1) Plastidome (2) Nucleosome (3) Polyhedral bodies (4) Polysome

Sol: [4]

83. Which of the following terms describe human dentition ?

(1) Pleurodont, Monophyodont, Homodont (2) Pleurodont, Diphyodont, Heterodont

(3) Thecodont, Diphyodont, Heterodont (4) Thecodont, Diphyodont, Homodont

Sol: [3]

84. Which of the following events does **not** occur in rough endoplasmic reticulum ?

(1) Cleavage of signal peptide (2) Phospholipid synthesis

(3) Protein glycosylation (4) Protein folding

Sol: [2]

85. Select the **incorrect** match :

(1) Submetacentric chromosomes – L-shaped chromosomes

(2) Polytene chromosomes – Oocytes of amphibians

(3) Allosomes – Sex chromosomes

(4) Lampbrush chromosomes – Diplotene bivalents

Sol: [2]

86. AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA ?

(1) ACCUAUGCGAU (2) UCCAUAGCGUA

(3) UGGTUTCGCAT (4) AGGUAUCGCAU

Sol: [4]

87. According to Hugo de Vries, the mechanism of evolution is

(1) Phenotypic variations (2) Minor mutations

(3) Saltation (4) Multiple step mutations

Sol: [3]

88. Match the items given in Column I with those in Column II and select the **correct** option given below :

	Column I		Column II
a.	Proliferative Phase	i.	Breakdown of endometrial lining
b.	Secretory Phase	ii.	Follicular Phase
c.	Menstruation	iii.	Luteal Phase

	a	b	c
(1)	ii	iii	i
(2)	iii	i	ii
(3)	i	iii	ii
(4)	iii	ii	i

Sol: [1]

89. All of the following are part of an operon except

(1) an enhancer (2) a promoter

(3) structural genes (4) an operator

Sol: [1]

90. A woman has an X-linked condition on one of her X chromosomes. This chromosome can be inherited by

(1) Only grandchildren (2) Both sons and daughters

(3) Only sons (4) Only daughters

Sol: [2]

91. A tunning fork is used to produce resonance in a glass tube. The length of the air column in the tube can be adjusted by a variable piston. At room temperature of 27°C two successive resonances are produced at 20 cm and 73 cm of column length. If the frequency of the tuning fork is 320 Hz, the velocity of sound in air at 27°C is

(1) 350 m/s (2) 300 m/s (3) 339 m/s (4) 330 m/s

Sol: [3] $v = 2f(l_2 - l_1) = 2 \times 320 \times 0.53 = 339$ m/s

92. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and are A is

(1) proportional to the square root of the distance between the plates

(2) inversely proportional to the distance between the plates

(3) linearly proportional to the distance between the plates

(4) independent of the distance between the plates

Sol: [4] $F = \frac{Q^2}{2\varepsilon_0 A}$

93. An electron falls from rest through a vertical distance h in a uniform and vertically upward directed electric field E. The direction of electric field is now reversed, keeping its magnitude the same. A proton is allowed to fall from rest in it through the same vertical distance h. The time of fall of the electron, in comparison to the time of fall of the proton is

(1) 10 times greater (2) equal (3) 5 times greater (4) smaller

Sol: [4] $a = \dfrac{mg + qE}{m}$

$a = g + \dfrac{qE}{m}$

$m_e < m_p$

$\therefore \quad a_e > a_p$

$t_e < t_p$

94. A pendulum is hung from the roof of a sufficiently high building and is moving freely to and fro like a simple harmonic oscillator. The acceleration of the bob of the pendulum is 20 m/s^2 at a distance of 5 m from the mean position. The time period of oscillation is

(1) 2 s (2) 1 s (3) π s (4) 2π s

Sol: [3] $|a| = \omega^2 y$

$20 = \omega^2 \times 5$

$\omega = 2$ rad/s

$T = \dfrac{2\pi}{\omega} = \pi$ s

95. Current sensitivity of a moving coil galvanometer is 5 div/mA and its voltage sensitivity (angular deflection per unit voltage applied) is 20 div/V. The resistance of the galvanometer is

(1) 250 Ω (2) 500 Ω (3) 25 Ω (4) 40 Ω

Sol: [1] $I_s = V_s R$

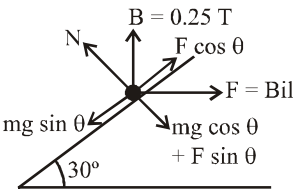
$5000 = 20 \times R$

$R = 250\ \Omega$

96. A metallic rod of mass per unit length 0.5 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 30° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of induction 0.25 T is acting on it in the vertical direction. The current flow in the rod to keep it stationary is

(1) 14.76 A (2) 11.32 A (3) 5.98 A (4) 7.14 A

Sol: [2]



$BiI \cos\theta = mg \sin\theta$

$0.25 \times i \times 1 \times \dfrac{\sqrt{3}}{2} = 0.5 \times 9.8 \times \dfrac{1}{2}$

$i = 11.32$ A

97. A thin diamagnetic rod is placed vertically between the poles of an electromagnet. When the current in the electromagnet is switched on, then the diamagnetic rod is pushed up, out of the horizontal magnetic field. Hence the rod gains gravitational potential energy. The work required to do this comes form

(1) the lattice structure of the material of the rod

(2) the induced electric field due to the changing magnetic field

(3) the magnetic field

(4) the current source

Sol: [2] Conceptual

98. An inductor 20 mH, a capacitor 100 μF and a resistor 50 Ω are connected in series across a source of emf, V = 10 sin 314 t. The power loss in the circuit is

(1) 2.74 W (2) 1.13 W (3) 0.43 W (4) 0.79 W

Sol: [4] $\omega = 314$ rad/s

$X_L = 20 \times 10^{-3} \times 314 = 6.28\ \Omega$

$$X_C = \frac{1}{100 \times 10^{-6} \times 314} = 31.85\ \Omega$$

$$I_{rms} = \frac{V_{rms}}{Z}$$

$$Z = \sqrt{(X_L - X_C)^2 + R^2} = 56.16\ \Omega$$

$$I_{rms} = \frac{10}{56.16 \times \sqrt{2}} = 0.126\ \text{A}$$

$$P = I_{rms}^2 R = 0.79\ \text{W}$$

99. An object is placed at a distance of 40 cm from concave mirror of focal length 15 cm. If the object is displaced through a distance of 20 cm towards the mirror, the displacement of the image will be

(1) 30 cm towards the mirror

(2) 36 cm towards the mirror

(3) 36 cm away from the mirror

(4) 30 cm away from the mirror

Sol: [3] $\frac{1}{v_1} - \frac{1}{40} = -\frac{1}{15}$

$v_1 = -24$ cm

$\frac{1}{v_2} - \frac{1}{20} = -\frac{1}{15}$

$v_2 = -60$ cm

$v_2 - v_1 = -36$ cm

100. An em wave is propagating in a medium with a velocity $\vec{V} = V\hat{i}$. The instantaneous oscillating electric field of this em wave is along +y axis. Then the direction of oscillating magnetic field of the em wave will be along

(1) – y direction (2) – x direction (3) +z direction (4) – z direction

Sol: [3] $\vec{v}$ along $\vec{E} \times \vec{B}$

$\therefore \quad \hat{j} \times \hat{k} = \hat{i}$

101. The magnetic potential energy stored in a certain inductor is 25 mJ, when the current in the inductor is 60 mA. This inductor is of inductance

(1) 1.389 H (2) 13.89 H (3) 138.88 H (4) 0.138 H

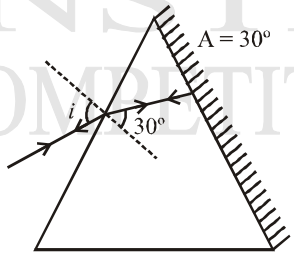
Sol: [2] $25 \times 10^{-3} = \frac{1}{2} \times L \times (60 \times 10^{-3})^2$

$$L = \frac{50 \times 10^{-3}}{3600 \times 10^{-6}} = 13.89 \text{ H}$$

102. The refractive index of the material of a prism is $\sqrt{2}$ and the angle of the prism is 30°. One of the two refracting surfaces of the prism is made a mirror inwards, by silver coating. A beam of monochromatic eight entering the prism form the other face will retrace its path (after reflection from the silvered surface) if its angle of incidence on the prism is

(1) 30° (2) zero (3) 45° (4) 60°

Sol: [3]



$\sin i = \mu \sin 30^\circ$

$$\sin i = \sqrt{2} \times \frac{1}{2}$$

$i = 45^\circ$

103. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is

(1) 2 : –1 (2) 1 : –2 (3) 1 : –1 (4) 1 : 1

Sol: [3] $E = -K$

$$\frac{K}{E} = \frac{1}{-1}$$

104. An electron of mass m with an initial velocity $\vec{V} = V_0\hat{i}\,(V_0 > 0)$ enters an electric field $\vec{E} = -E_0 i\,(E_0 =$ constant > 0) at t = 0. If λ_0 is its de-Broglie wavelength initially, then its de-Broglie wavelength at time t is

(1) $\lambda_0 t$ (2) λ_0 (3) $\lambda_0\left(1+\frac{eE_o}{mV_0}t\right)$ (4) $\frac{\lambda_0}{\left(1+\frac{eE_o}{mV_0}t\right)}$

Sol: [4] $\lambda_0 = \frac{h}{mV_0}$

$v = V_0 + \frac{eE_0}{m}t$

$\lambda = \frac{h}{m\left(V_0 + \frac{eE_0 t}{m}\right)}$

$\lambda = \frac{mV_0\lambda_0}{m\left(V_0 + \frac{eE_0 t}{m}\right)}$

$\lambda = \frac{\lambda_0}{1+\frac{eE_0 t}{mV_0}}$

105. For a radioactive material half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) of the disintegration of 450 nuclei is

(1) 30 (2) 15 (3) 10 (4) 20

Sol: [4] $150 = \frac{600}{2^n}$

$2^n = 4$

$n = 2$

$t = 10 \times 2 = 20$ min.

106. When the light of frequency $2v_0$ (where v_0 is threshold frequency), is incident on a metal plate, the maximum velocity of electrons emitted is v_1. When the frequency of the incident radiation is increased to $5v_0$, the maximum velocity of electrons emitted form the same plate is v_2. The ratio of v_1 to v_2 is

(1) 4 : 1 (2) 2 : 1 (3) 1 : 4 (4) 1 : 2

Sol: [4] $\frac{1}{2}mv_1^2 = 2hv_0 - hv_0$

$\frac{1}{2}mv_1^2 = hv_0$ ... (i)

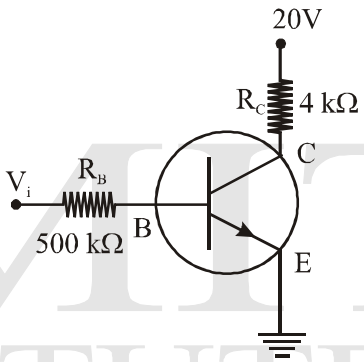
$$\frac{1}{2}mv_2^2 = 5h\nu_0 - h\nu_0$$

$$\frac{1}{2}mv_2^2 = 4h\nu_0$$

$$\therefore \quad \frac{v_1^2}{v_2^2} = \frac{1}{4}$$

$$\frac{v_1}{v_2} = \frac{1}{2}$$

107. In the circuit shown in the figure, the input voltage V_i is 20 V, V_{BE} = 0 and V_{CE} = 0. The value of I_B, I_C and β are given by



(1) I_B = 20 μA, IC = 5 mA, β = 250 (2) I_B = 40 μA, I_C = 5 mA, β = 125

(3) I_B = 25 μA, I_C = 5 mA, β = 200 (4) I_B = 40 μA, I_C = 10 mA, β = 250

Sol: [2] $I_B = \frac{20}{500}\text{mA} = 40\ \mu\text{A}$

$$I_C = \frac{20}{4}\text{mA} = 5\text{mA}$$

$$\beta = \frac{I_C}{I_B} = \frac{5\times10^{+3}}{40} = 125$$

108. In a p-n junction diode, change in temperature due to heating

(1) does not affect resistance of p-n junction

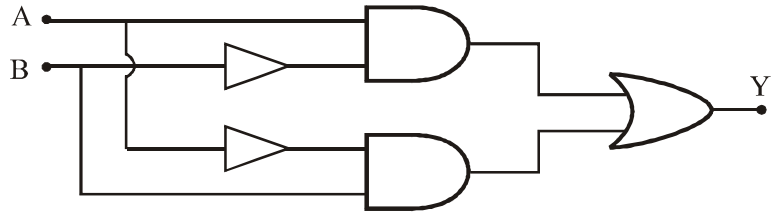
(2) affects the overall V – I characteristic of p-n junction

(3) affects only forward resistance

(4) affects only reverse resistance

Sol: [2] Conceptual

109. In the combination of the following gates the output Y can be written in terms of input A and B as



(1) $\overline{A.B} + A.B$ (2) $\overline{A+B}$ (3) $A.\overline{B} + \overline{A}.B$ (4) $\overline{A.B}$

Sol: [3] Out put $A.\overline{B} + \overline{A}.B$

110. A carbon resistor of (47 ± 4.7) kΩ is to be marked with rings of different colour for its identification. The colour code sequence will be

(1) Yellow – Green – Violet – Gold (2) Green – Orange – Violet – Gold

(3) Yellow – Violet – Orange – Silver (4) Violet – Yellow – Orange – Silver

Sol: [3] Yellow → Violet → Orange → Silver

111. A set of 'n' equal resistors, of value R each are connected in series to a battery of emf E and internal resistance 'R'. The current drawn is I. Now, the 'n' resistors are connected in parallel to the same battery. Then the current drawn from battery becomes 10 I. The value of 'n' is

(1) 20 (2) 9 (3) 11 (4) 10

Sol: [4] $I = \dfrac{E}{nR+R}$

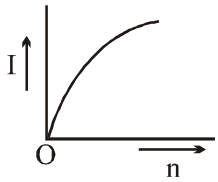
$$10I = \frac{E}{\frac{R}{n}+R}$$

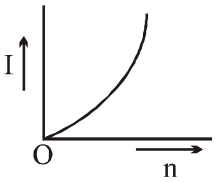
$$\therefore \quad \frac{10E}{nR+R} = \frac{E}{\frac{R}{n}+R}$$

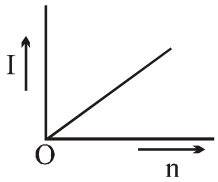
$$\frac{10}{n} + 10 = n + 1$$

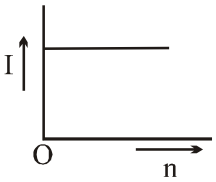
$\therefore \quad n = 10$

112. A battery consists of a variable number 'n' of identical cells (having internal resistance 'r' each) which are connected in series. The terminals of the battery are short-circuited and the current I is measured. Which of the graphs shows the correct relationship between I and n?

(1) 

(2) 

(3) 

(4) 

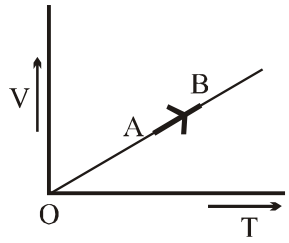
Sol: [4] $I = \dfrac{nE}{nr} = \dfrac{E}{r}$

113. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is

(1) 6.25% (2) 12.5% (3) 20% (4) 26.8%

Sol: [4] $\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100 = \left(1 - \frac{273}{373}\right) \times 100 = 26.8\%$

114. The volume (V) of a monoatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B is



(1) 1 / 3 (2) 2 / 7 (3) 2 / 3 (4) 2 / 5

Sol: [4] For isobaric process

$\Delta W = nR\Delta T$

$\Delta Q = nC_p\Delta T = \frac{5nR\Delta T}{2}$

$\frac{\Delta W}{\Delta Q} = \frac{2}{5}$

115. The fundamental frequency in an open organ pipe is equal to the third harmonic of a closed organ pipe. If the length of the closed organ pipe is 20 cm, the length of the open organ pipe is

(1) 12.5 cm (2) 16 cm (3) 8 cm (4) 13.2 cm

Sol: [4] $\frac{v}{2l_1} = \frac{3v}{4l_2}$

$l_1 = \frac{2l_2}{3} = \frac{2 \times 20}{3} = 13.3 \text{ cm}$

116. At what temperature will the rms speed of oxygen molecules become just sufficient for escaping from the Earth's atmosphere? (Given: Mass of oxygen molecule (m) = 2.76×10^{-26} kg, Boltzmann's constant $k_B = 1.38 \times 10^{-23}$ JK^{-1})

(1) 5.016×10^4 K (2) 1.254×10^4 K (3) 8.360×10^4 K (4) 2.508×10^4 K

Sol: [3] $v_{rms} = \sqrt{\frac{3kT}{m}} = v_e$

$T = \frac{mv_e^2}{3k} = \frac{2.76 \times 10^{-26} \times (11.2 \times 10^3)^2}{3 \times 1.38 \times 10^{-23}} = 8.36 \times 10^4$ K

117. The power radiated by a black body is P and it radiates maximum energy at wavelength λ_0. If the temperature of the black body is now changed so that it radiates maximum energy at wavelength $(3/4)\lambda_0$, the power radiated by it becomes nP. The value of n is

(1) $\frac{256}{81}$ (2) $\frac{81}{256}$ (3) $\frac{4}{3}$ (4) $\frac{3}{4}$

Sol: **[1]** $T_1\lambda_0 = T_2 \times \frac{3\lambda_0}{4}$ $\therefore \quad T_2 = \frac{4}{3}T_1$

$P \propto T^4$

$\therefore \quad P' = \frac{256}{81}P$

118. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount ?

(1) 4 F (2) F (3) 6 F (4) 9 F

Sol: **[4]** $\Delta t = \frac{FL}{YA} = \frac{FV}{YA^2}$ $\frac{F_1}{A_1^2} = \frac{F_2}{A_2^2}$ $\therefore F_2 = 9\ F$

119. A small sphere of radius 'r' falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to

(1) r^5 (2) r^4 (3) r^2 (4) r^3

Sol: **[1]** Rate of production of heat = loss in gravitational P.E per second

$= mg\ v_t \ \propto r^5 \quad (\because m \propto r^3)$

120. A sample of 0.1 g of water at 100°C and normal pressure (1.013×10^5 Nm^{-2}) requires 54 cal of heat energy to convert to steam at 100°C. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample, is

(1) 42.2 J (2) 84.5 J (3) 208.7 J (4) 104.3 J

Sol: **[3]** $\Delta W = P\Delta V$ $1.013 \times 10^5 \times (167.1 \times 10^{-6} - 0.1 \times 10^{-6})$

$= 1.013 \times 10^5 \times 167 \times 10^{-6}$

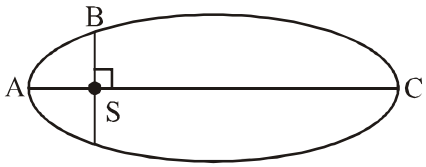
$= 16.9$ J

$\Delta Q = 54$ cal $= 54 \times 4.18$

$= 225.72$ J

$\Delta U = \Delta Q - \Delta W = 208.7$ J

121. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C, respectively. AC is the major axis and SB is perpendicular to AC at the position of the Sun S as shown in the figure. Then



(1) $K_B < K_A < K_C$ (2) $K_B < K_A > K_C$ (3) $K_A > K_B > K_C$ (4) $K_A < K_B < K_C$

Sol: [3] By conservation of angular momentum, $K_C < K_B < K_A$

122. A solid sphere is in rolling motion. In rolling motion a body possesses translational kinetic energy (K_t) as well as rotational kinetic energy (K_r) simultaneously. The ratio $K_t : (K_t + K_r)$ for the sphere is

(1) 10:7 (2) 2 : 5 (3) 5 : 7 (4) 7 : 10

Sol: [3] $$\frac{K_t}{K_t + K_r} = \frac{\frac{1}{2}mv^2}{\frac{1}{2}mv^2 + \frac{1}{2}\times\frac{2}{5}mv^2} = \frac{5}{7}$$

123. A solid sphere is rotating freely about its symmetry axis in free space. The radius of the sphere is increased keeping its mass same. Which of the following physical quantities would remain constant for the sphere?

(1) Rotational kinetic energy (2) Angular momentum
(3) Moment of inertia (4) Angular velocity

Sol: [2] $K_R = \frac{L^2}{2I}$

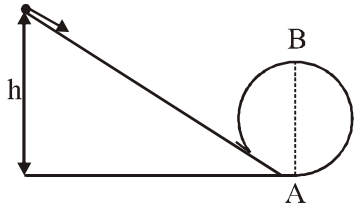
L = constant

124. If the mass of the Sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is ***not*** correct ?

(1) Time period of a simple pendulum on the Earth would decrease.
(2) 'g' on the Earth will not change
(3) Walking on the ground would become more difficult.
(4) Raindrops will fall faster.

Sol: [2] $g = \frac{GM_e}{R_e^2}$

125. A body initially at rest and sliding along a frictionless track from a height h (as shown in the figure) just completes a vertical circle of diameter AB = D. The height h is equal to



(1) $\frac{7}{5}$D (2) $\frac{5}{4}$D

(3) D (4) $\frac{3}{2}$D

Sol: [2] $mgh = \frac{1}{2}m\times\frac{5gD}{2}$

$h = \frac{5D}{4}$

126. Three objects, A: (a solid sphere), B: (a thin circular disk) and C: (a circular ring), each have the same mass M and radius R. They all spin with the same angular speed ω about their own symmetry axes. The amounts of work (W) required to bring them to rest, would satisfy the relation

(1) $W_B > W_A > W_C$ (2) $W_A > W_C > W_B$ (3) $W_A > W_B > W_C$ (4) $W_C > W_B > W_A$

Sol: [4] $W = \frac{1}{2} I \omega^2$

$I_{ring} > I_{disk} > I_{sphere}$

127. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be

(1) 0.8 (2) 0.4 (3) 0.25 (4) 0.5

Sol: [3] $mv = 4\,mV$

$V = \frac{v}{4}$

$e = \frac{V}{v} = \frac{1}{4} = 0.25$

128. Which one ' of the' following statements is ***incorrect*****?**

(1) Frictional force opposes the relative motion.

(2) Coefficient of sliding friction has dimensions of length.

(3) Limiting value of static friction is directly proportional to normal reaction.

(4) Rolling friction is smaller than sliding friction.

Sol: [2] Conceptual

129. The moment of the force, $\vec{F} = 4\hat{i} + 5\hat{j} - 6\hat{k}$ at (2, 0, –3), about the point (2, –2, –2), is given by

(1) $-7\hat{i} - 8\hat{j} - 4\hat{k}$ (2) $-7\hat{i} - 4\hat{j} - 8\hat{k}$ (3) $-4\hat{i} - \hat{j} - 8\hat{k}$ (4) $-8\hat{i} - 4\hat{j} - 7\hat{k}$

Sol: [2] $\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{r} = (2-2)\hat{i} + (0+2)\hat{j} + (-3+2)\hat{k} = 2\hat{j} - \hat{k}$

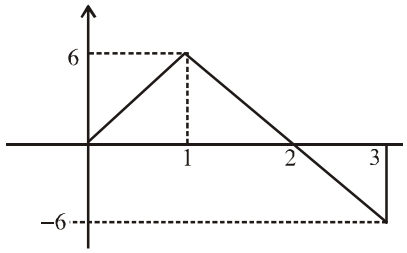
$\vec{\tau} = (2\hat{j} - \hat{k}) \times (4\hat{i} + 5\hat{j} - 6\hat{k})$

$= -8\hat{k} - 12\hat{i} - 4\hat{j} + 5\hat{i} = -7\hat{i} - 4\hat{j} - 8\hat{k}$

130. A toy car with charge q moves on a frictionless horizontal plane surface under the influence of a uniform electric field $\vec{E}$. Due to the force $q\vec{E}$, its velocity increases from 0 to 6 m/s in one second duration. At that instant the direction of the field is reversed. The car continues to move for two more seconds under the influence of this field. The average velocity and the average speed of the toy car between 0 to 3 seconds are respectively

(1) 1 m/s, 3.5 m/s (2) 1.5 m/s, 3 m/s (3) 1 m/s, 3m/s (4) 2 m/s, 4 m/s

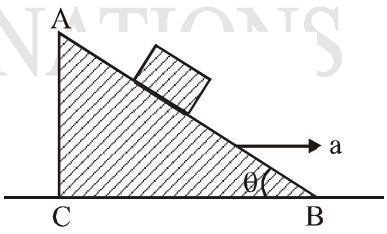
Sol: [3]



$$\text{Average velocity} = \frac{6-3}{3} = 1\ \text{m/s}$$

$$\text{Average speed} = \frac{6+3}{3} = 3\ \text{m/s}$$

131. A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration '*a*' towards the right. The relation between a and θ for the block to remain stationary on the wedge is



(1) $a = g\cos\theta$ (2) $a = g\tan\theta$

(3) $a = \frac{g}{\sin\theta}$ (4) $a = \frac{g}{\text{cosec}\,\theta}$

Sol: [2] $mg\sin\theta = ma\cos\theta$

$\therefore \quad a = g\tan\theta$

132. A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of –0.004 cm, the correct diameter of the ball is

(1) 0.053 cm (2) 0.529 cm (3) 0.525 cm (4) 0.521 cm

Sol: [2] $d = 0.5 + 25 \times 0.001 + 0.004 = 0.529$ cm

133. Unpolarised light is incident from air on a plane surface of a material of refractive index 'μ'. At a particular angle of incidence '*i*', it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation ?

(1) $i = \sin^{-1}\left(\frac{1}{\mu}\right)$

(2) $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

(3) Reflected light is polarised with its electric vector perpendicular to the plane of incidence

(4) Reflected light is polarised with its electric vector parallel to the plane of incidence

Sol: [4] $\mu = \tan i$

$i = \tan^{-1}(\mu)$

134. In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength λ of the light used is 5896 Å and distance D between the screen and slits is 100 cm. It is found that the angular width of the fringes is 0.20°. To increase the fringe angular width to 0.21° (with same λ and D**)** the separation between the slits needs to be changed to

(1) 2.1 mm (2) 1.7 mm (3) 1.9 mm (4) 1.8 mm

Sol: [3] $d = 2$ mm

$\lambda = 5896$ Å

$D = 100$ cm

$\theta = \frac{\lambda}{d}$

$\theta_1 d_1 = \theta_2 d_2$

$0.20 \times 2 = 0.21 \times d_2$

$d_2 = \frac{40}{21} = 1.9$ mm

135. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of

(1) large focal length and large diameter (2) small focal length and small diameter

(3) large focal length and small diameter (4) small focal length and large diameter

Sol: [1] Factual

136. In which case is the number of molecules of water maximum?

(1) 0.00224 L of water vapours at 1 atm and 273 K

(2) 10^{-3} mol of water

(3) 0.18 g of water

(4) 18 mL of water

Sol: [4] 0.00224 L water vapours = 10^{-3} mole of water vapours

18 ml of water = 18 g water = 1 mole water = 6.02×10^{23} molecule

137. Consider the change in oxidation state of Bromine corresponding to different emf values as shown in the diagram below:

$$BrO_4^- \xrightarrow{1.82V} BrO_3^- \xrightarrow{1.5V} HBrO \xrightarrow{1.595} Br_2 \xrightarrow{1.00652V} Br^-$$

Then the species undergoing disproportionation is

(1) Br_2 (2) HBrO (3) BrO_4^- (4) BrO_3^-

Sol: [2] $HBrO \longrightarrow BrO_3^-$ $E^0 = -1.5$ V

$HBrO \longrightarrow Br_2$ $\mathbf{E^0 =}$ + 1.595

$E^0 = +0.095$ Spontaneous

138. Among CaH_2, BeH_2, BaH_2, the order of ionic character is:

(1) $BeH_2 < BaH_2 < CaH_2$ (2) $BaH_2 < BeH_2 < CaH_2$

(3) $CaH_2 < BeH_2 < BaH_2$ (4) $BeH_2 < CaH_2 < BaH_2$

Sol: [4] $BeH_2 < CaH_2 < BaH_2$

139. The correct difference between first- and second-order reactions is that

(1) a first-order reaction can be catalyzed; a second-order reaction cannot be catalysed

(2) the rate of a first-order reaction does depend on reactant concentration; the rate of a second-order reaction does not depend on reactant concentration

(3) the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second-order reaction does depend on $[A]_0$

(4) the rate of a first-order reaction does not depend on reactant concentrations; the rate of a second-order reaction does depend on reactant concentrations

Sol: [3]

140. The type of isomerism shown by the complex $[CoCl_2(en)_2]$ is

(1) Ionization isomerism (2) Linkage isomerism

(3) Coordination isomerism (4) Geometrical isomerism

Sol: [4]

141. Which one of the following ions exhibits d-d transition and paramagnetism as well?

(1) MnO_4^- (2) MnO_4^{2-} (3) $Cr_2O_7^{2-}$ (4) CrO_4^{2-}

Sol: [2] d-d transition and paramagnetism is possible when their is presence of unpaired electron in d-orbital.

142. The geometry and magnetic behaviour of the complex $[Ni(CO)_4]$ are

(1) square planar geometry and paramagnetic

(2) tetrahedral geometry and paramagnetic

(3) tetrahedral geometry and diamagnetic

(4) square planar geometry and diamagnetic

Sol: [3]

143. Iron carbonyl, $Fe(CO)_5$ is

(1) trinuclear (2) dinuclear (3) mononuclear (4) tetranuclear

Sol: [3]

144. Match the metal ions given in Column I with the spin magnetic moments of the ions given in Column II and assign the ***correct*** code:

Column I	Column II
a. Co^{3+}	i. $\sqrt{8}$ B.M.
b. Cr^{3+}	ii. $\sqrt{35}$ B.M.
c. Fe^{3+}	iii. $\sqrt{3}$ B.M.
d. Ni_{2+}	iv. $\sqrt{24}$ B.M.
	v. $\sqrt{15}$ B.M.

	a	b	c	d
(1)	iv	i	ii	iii
(2)	iii	v	i	ii
(3)	i	ii	iii	iv
(4)	iv	v	ii	i

Sol: [4] Co (27) $3d^7 4s^2$ 

Co^{3+} $3d^6 4s^0$ 4 unpaired electrons

$\sqrt{n(n+2)}$ B.M. $\sqrt{4(4+2)}$ B.M. $= \sqrt{24}$ B.M.

Cr^{3+} $3d^3 4s^0$ 3 unpaired electrons $\sqrt{3(3+2)}$ B.M.

$= \sqrt{15}$ B.M.

Fe^{3+} $3d^5 4s^0$ 5 unpaired electrons $\sqrt{5(5+2)}$ $\sqrt{35}$ B.M.

Ni^{2+} $3d^8 4s^0$ 2 unpaired elctrons $\sqrt{2(2+2)}$ B.M. $\sqrt{8}$ B.M.

145. Which one of the following elements is unable to form MF_6^{3-} ion?

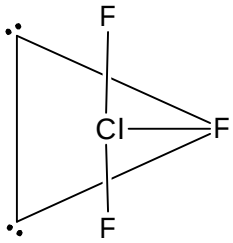
(1) B (2) In (3) Al (4) Ga

Sol: [1] B due to absence of vacant d-orbitals.

146. In the structure of ClF_3, the number of lone pairs of electrons on central atom 'Cl' is

(1) four (2) three (3) two (4) one

Sol: [3]



147. The correct order of N-compounds in its decreasing order of oxidation states is

(1) HNO_3, NH_4Cl, NO, N_2 (2) NH_4Cl, N_2, NO, HNO_3

(3) HNO_3, NO, NH_4Cl, N_2 (4) HNO_3, NO, N_2, NH_4Cl

Sol: [4] $\overset{+5}{H}\overset{}{N}O_3; \overset{+2}{N}O; \overset{0}{N}_2; \overset{-3}{N}H_4Cl$

148. Which of the following statements is ***not*** true for halogens?

(1) All but fluorine show positive oxidation states.

(2) Chlorine has the highest electron-gain enthalpy.

(3) All are oxidizing agents.

(4) All form monobasic oxyacids.

Sol: [1]

149. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?

(1) Mg (2) Cu (3) Zn (4) Fe

Sol: [1]

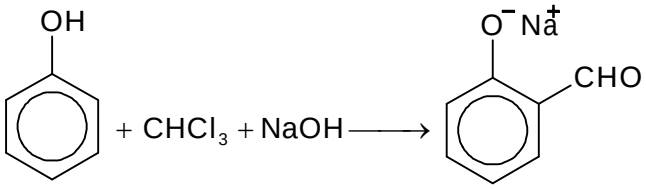
150. The correct order of atomic radii in group 13 elements is

(1) B < Ga < Al < Tl < In (2) B < Ga < Al < In < Tl

(3) B < Al < Ga < In < Tl (4) B < Al < In < Ga < Tl

Sol: [2] B < Ga < Al < In < Tl

151. In the reaction

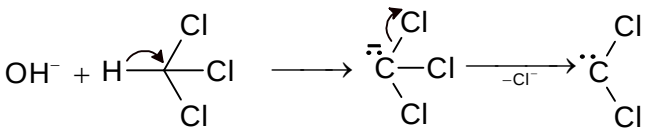


the electrophile involved is

(1) dichlormethyl anion $(\overset{\ominus}{C}HCl_2)$ (2) dichlorocarbene $(:CCl_2)$

(3) formyl cation $(\overset{\oplus}{C}HO)$ (4) dichlromethyl cation $(\overset{\oplus}{C}HCl_2)$

Sol: [2] Question is based on Reimer Tiemnn Reaction



dichlorocarbene

152. Carboxylic acids have higher boiling points than aldehydes, ketones and even alcohols of comparable molecular mass. It is due to their

(1) more extensive association of carboxylic aicd via van der Waals force of attraction

(2) formation of intermolecular H-bonding

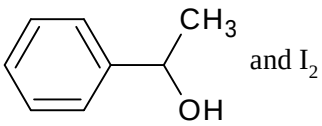
(3) formation of carboxylate ion

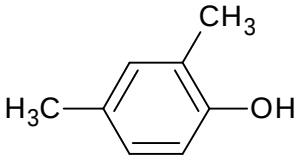
(4) formation of intramolecular H-bonding

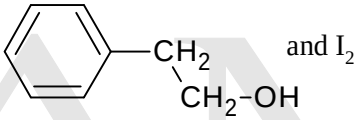
Sol: [2] Due to formation of intermolecular H-bonding.

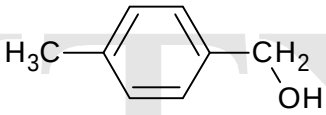
153. Compound A, $C_8H_{10}O$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell.

A and Y are respectively

(1)  and I_2

(2)  and I_2

(3)  and I_2

(4)  and I_2

Sol: [1] Iodoform reaction

154. Which of the following molecules represents the order of hybridisation sp^2, sp^2, sp, sp from left to right atoms?

(1) $CH_2 = CH - CH = CH_2$ (2) $CH_3 - CH = CH - CH_3$

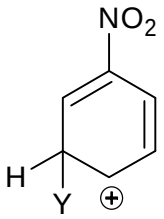
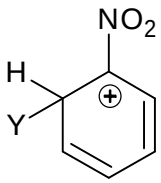
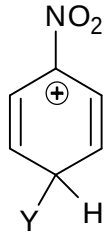
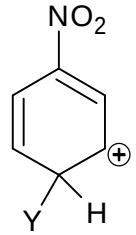
(3) $CH_2 = CH - C \equiv CH$ (4) $HC \equiv C - C \equiv CH$

Sol: [3]

$H_2C{=}CH{-}C{\equiv}CH$

sp^2 sp^2 sp sp

155. Which of the following carbocations is expected to be most stable?

(1)  (2)  (3)  (4) 

Sol: [1] $-NO_2$ is an EWG and C^+ is furthermost from $-NO_2$

156. Which of the following is correct with respect to – I effect of the substituents? (R = alkyl)

(1) $-NH_2 > -OR > -F$ (2) $-NR_2 > -OR > -F$

(3) $-NR_2 < -OR < -F$ (4) $-NH_2 < -OR < -F$

Sol: [4] On the basis of electronegativity of atom.

157. Regarding cross-linked or network polymers, which of the following statements is ***incorrect?***

(1) Examples are bakelite and melamine.

(2) They contain strong covalent bonds in thier polymer chains.

(3) They are formed from bi- and tri-functional monomers.

(4) They contain covalent bonds between various linear polymer chains.

Sol: [4]

158. Nitration of aniline in strong acidic medium also gives m-nitroaniline because

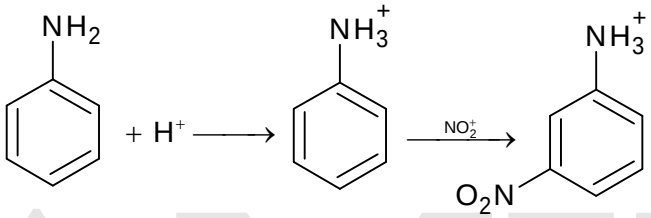
(1) In absence of substituents nitro group always goes to m-position

(2) In acidic (strong) medium aniline is present as anilinium ion.

(3) In electrophilic substitution reactions amino group is meta directive.

(4) In spite of substituents nitro group always goes to only m-position

Sol: [2]



159. The difference between amylose and amylopectin is

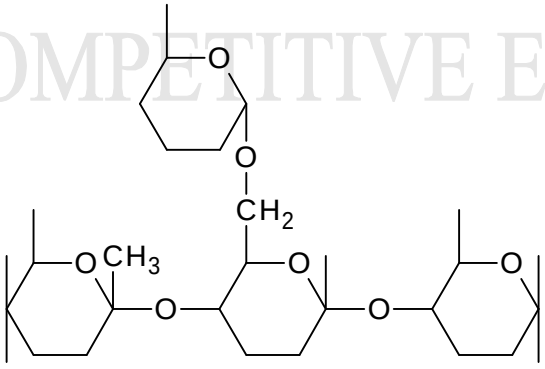
(1) Amylopectin have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ β-linkage

(2) Amylose is made up of glucose and galactose

(3) Amylose have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ β-linkage

(4) Amylopectin have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ α-linkage

Sol: [4]



Amylopectin

160. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP) will be

(1) 2.8 (2) 4.4 (3) 3.0 (4) 1.4

Sol: [1] $HCOOH \xrightarrow{\text{conc. } H_2SO_4} CO + H_2O$

$$\begin{matrix} COOH \\ | \\ COOH \end{matrix} \xrightarrow{\text{conc. } H_2SO_4} CO_2 + CO + H_2O$$

$\frac{1}{10}$ moles of CO are left

Hence weight is $\frac{1}{10} \times 28 = 2.8$ g

161. Which of the following oxides is most acidic in nature?

(1) BaO (2) CaO (3) BeO (4) MgO

Sol: [3]

162. For the redox reaction

$$MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$$

the correct coefficients of the reactants for the balanced equation are

	MnO_4^-	$C_2O_4^{2-}$	H^+
(1)	2	16	5
(2)	5	16	2
(3)	2	5	16
(4)	16	5	2

Sol: [3] $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

163. Which one of the following conditions will favour maximum formation of the product in the reaction,

$$A_2(g) + B_2(g) \rightleftharpoons X_2(g) \quad \Delta_r H = -X\,kJ?$$

(1) High temperature and high pressure (2) High temperature and low pressure

(3) Low temperature and low pressure (4) Low temperature and high pressure

Sol: [4] According to Le Chatellier's principle

164. When initial concentration of the reactant is doubled, the half-life period of a zero order reaction

(1) is tripled (2) remains unchanged

(3) is doubled (4) is halved

Sol: [3] $t_{1/2}$ for zero order $\propto$ a

165. The bond dissociation energies of X_2, Y_2 and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is – 200 kJ mol^{-1}. The bond dissociation energy of X_2 will be

(1) 800 kJ mol^{-1} (2) 400 kJ mol^{-1} (3) 100 kJ mol^{-1} (4) 200 kJ mol^{-1}

Sol: [4] $X - X + Y - Y \longrightarrow 2X - Y$

$$\Delta H = \sum \text{B.E.}_{\text{Reactant}} - \sum \text{B.E.}_{\text{Product}}$$

$$-400 = x + \frac{1}{2}x - 2x$$

$x = 800$ kJ mol^{-1}

166. The correction factor 'a' to the ideal gas equation corresponds to

(1) electric field present between the gas molecules

(2) forces of attraction between the gas molecules

(3) volume of the gas molecules

(4) density of the gas molecules

Sol: [2] Factual

167. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concnetrations:

a. $60\,mL\,\frac{M}{10}HCl + 40\ mL\,\frac{M}{10}NaOH$ b. $55\,mL\,\frac{M}{10}HCl + 45\ mL\,\frac{M}{10}NaOH$

c. $75\,mL\,\frac{M}{5}HCl + 25\ mL\,\frac{M}{5}NaOH$ d. $100\,mL\,\frac{M}{10}HCl + 100\ mL\,\frac{M}{10}NaOH$

pH of which one of them will be equal to 1?

(1) d (2) c (3) a (4) b

Sol: [2] 75 ml $\frac{M}{5}$ HCl = 15 milli mole of HCl

$25ml\,\frac{M}{5}NaOH$ = 5 milli mole of NaOH

5 milli mole of HCl present in 100 ml

Molarity = $\frac{10^{-2}\times 1000}{100} = 10^{-1}$ M HCl

pH = 1

168. On which of the following properties does the coagulating power of an ion depend?

(1) Both magnitude and sign of the charge on the ion

(2) The sign of charge on the ion alone

(3) Size of the ion alone

(4) The magnitude of the charge on the ion alone

Sol: [1] Hardy and Schulze rule

169. Given van der Waals constant for NH_3, H_2, O_2 and CO_2 are respectively 4.17, 0.244, 1.36 and 3.59, which one of hte following gases is most easily liquefied?

(1) O_2 (2) CO_2 (3) H_2 (4) NH_3

Sol: [4] Degree of liquification $\propto$ value of van der Waals constant.

170. The solubility of $BaSO_4$ in water is 2.42×10^{-3} gL^{-1} at 298 K. The value of its solubility product (K_{sp}) will be

(Given molar mass of $BaSO_4$ = 283 g mol^{-1})

(1) 1.08×10^{-14} mol^2 L^{-2} (2) 1.08×10^{-8} mol^2 L^{-2}

(3) $1{,}08 \times 10^{-12}$ mol^2 L^{-2} (4) 1.08×10^{-10} mol^2 L^{-2}

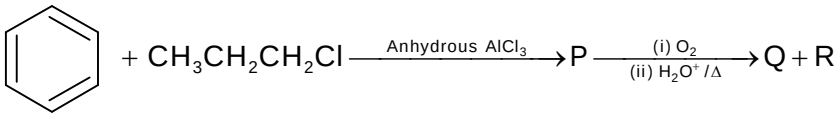
Sol: [4] $K_{sp} = S^2$

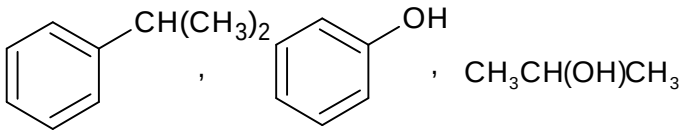
$$\text{Solubility in mole/litre} = \frac{242}{233} \times 10^{-5} = 1.038 \times 10^{-5}$$

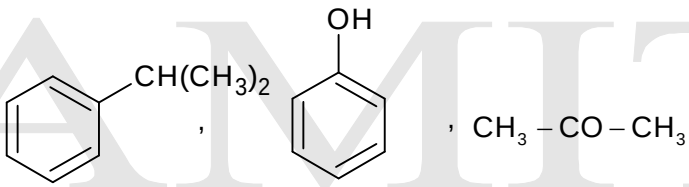
$K_{sp} = (1.038 \times 10^{-5})^2$

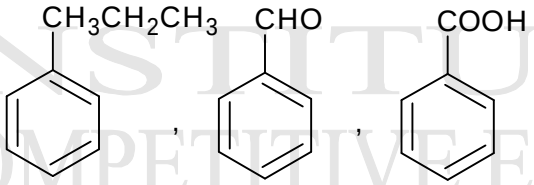
$K_{sp} = 1.08 \times 10^{-10}$

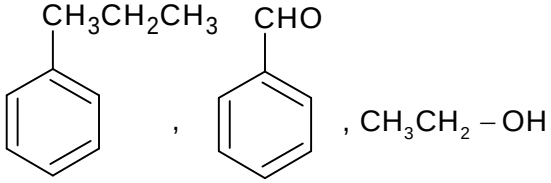
171. Identify the major products P, Q and R in the following sequence of reactions:



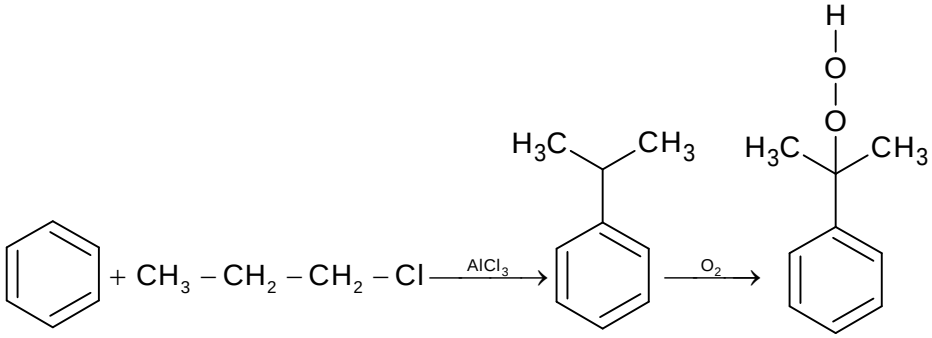
(1) 

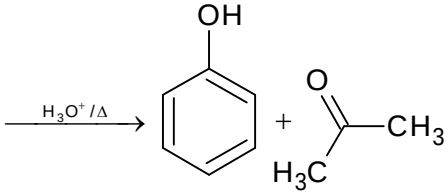
(2) 

(3) 

(4) 

Sol: [2]





172. Which of the following compounds can form a zwitterion?

(1) Benzoic acid (2) Glycine (3) Acetanilide (4) Aniline

Sol: [2] $NH_3^+ - CH_2 - COO^-$

173. The compound C_7H_8 undergoes the following reactions:

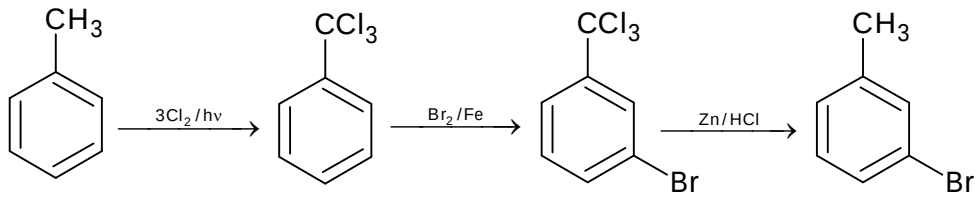
$$C_7H_8 \xrightarrow{3Cl_2/\Delta} A \xrightarrow{Br_2/Fe} B \xrightarrow{Zn/HCl} C$$

The product 'C' is:

(1) 3-bromo-2-4,6-trichlorotoluene (2) *p*-bromotoluene

(3) *o*-bromotoluene (4) *m*-bromotoluene

Sol: [4]



174. Which oxide of nitrogen is ***not*** a common pollutant introduced into the atmosphere both due to natural and human activity?

(1) N_2O (2) NO (3) NO_2 (4) N_2O_5

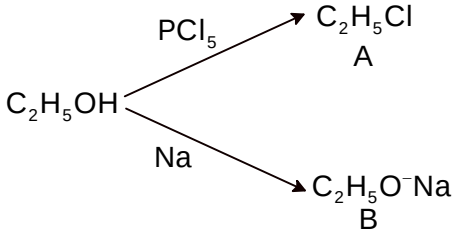
Sol: [4]

175. The compound A on treatment with Na gives B, and with PCl_5 gives C. B and C react together to give diethyl ether. A, B and C are in the order

(1) C_2H_5Cl, C_2H_6, C_2H_5OH (2) C_2H_5OH, C_2H_5ONa, C_2H_5Cl

(3) C_2H_5OH, C_2H_5Cl, C_2H_5ONa (4) C_2H_5OH, C_2H_6, C_2H_5Cl

Sol: [2]



$$A + B \longrightarrow C_2H_5OC_2H_5$$

176. Hydrocarbon (A) reacts with bromine by substitution to form an alkyl bromide which by Wurtz reaction is converted to gaseous hydrocarbon containing less than four carbon atoms (A) is

(1) $CH_3 - CH_3$ (2) CH_4 (3) $CH_2 = CH_2$ (4) $CH \equiv CH$

Sol: [2] $CH_4 + Br_2 \longrightarrow CH_3 - Br$

$$CH_3 - Br + 2Na + Br - CH_3 \longrightarrow CH_3 - CH_2 + 2NaBr$$

177. Consider the following species:

CN^+, CN^-, No and CN

Which one of these will have the highest bond order?

(1) CN^+ (2) CN (3) CN^- (4) NO

Sol: [3] Bond order of CN^- = 3

178. Magneisum reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2 2s^2 2p^3$, the simplest formula for the complound is:

(1) Mg_2X (2) Mg_3X_2 (3) MgX_2 (4) Mg_2X_3

Sol: [2]

179. Iron exhibits bcc structure at room temeprature. Above 900°C, it transforms to fcc structure. The ratio of density of iron at room temperature to that at 900°C (assuming molar mass and atomic radii of iron remains constant with temperature) is

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

Sol: [1] bcc fcc

$$r = \frac{\sqrt{3}}{4}a \qquad r = \frac{a}{2\sqrt{2}}$$

$$\rho = \frac{ZM}{a^3NA} \quad \rho = \frac{ZM}{a^3N_A}\rho_{bcc} = \frac{2\times M}{\frac{4}{3}\times\frac{\sqrt{3}}{4}}$$

$$r = \frac{\sqrt{3}}{4}a$$

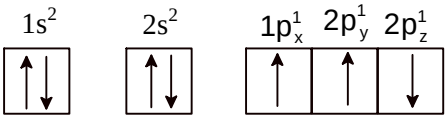
$$a = \frac{4r}{\sqrt{3}}\rho_{bcc} = \frac{2\times M}{\left(\frac{4r}{\sqrt{3}}\right)^3\times N_A} \quad ...(i)$$

$$\rho_{fcc} = \frac{4\times M}{(2\sqrt{2}r)^3\times N_A} \quad ...(ii)$$

$$\frac{\rho_{bcc}}{\rho_{fcc}} = \frac{2\times M}{\frac{64r^3}{3\sqrt{3}}}\times\frac{16\sqrt{2}r^3N_A}{4\times M} = \frac{3}{4}\frac{\sqrt{3}}{\sqrt{2}}$$

$$\frac{2\times16\sqrt{2}\times3\sqrt{3}}{\frac{64}{2}\times4} = \frac{\sqrt{2}\times3\sqrt{3}}{2\times4} = \frac{3\sqrt{3}}{\sqrt{2}\times4}$$

180. Which one is a ***wrong*** statement

(1) The electronic configuration of N atom is 

(2) The value of m for d_z2 is zero

(3) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbersw

(4) Total orbital angular momentum of electron in 's' orbital is equal to zero.

Sol: [1] Spin is changed

❑❑❑