BIOLOGY Max Marks: 360

(**SINGLE CORRECT ANSWER TYPE**)

This section contains 90 multiple choice questions. Each question has 4 options A), B), C) and D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

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1. The significant contributions of equational division are all **except**
   A) Restores nucleo-cytoplasmic ratio
   B) Increases genetic variability, important for evolution
   C) Responsible for growth of multicellular organism
   D) Helps in repair and regeneration process
2. Character of birds is:-
   A) Unisexual and sexual dimorphism absent
   B) Bisexual and sexual dimorphism absent
   C) Unisexual and sexual dimorphism present
   D) Bisexual and sexual dimorphism present
3. Radial symmetry is seen in :
   A) Mollusca B) Protozoa
   C) Starfish D) Sponges
4. Select the **correct** option stating true (T) and false (F) w.r.t. ribosomes
   i) Protein synthesis in eukaryotic cell occurs on the ribosomes in nucleus
   ii) Ribosomes are the granular structures first observed under the electron microscope by Palade
   iii) The sedimentation coefficient is indirect measure of density and size.

	(i)	(ii)	(iii)
A)	T	T	T
B)	F	F	F
C)	T	F	T
D)	F	T	T

5 Sister chromatids separate during
   A) Anaphase-II B) Anaphase
   C) Telophase-I D) Both (A) & (B)
6. "Polymorphism" is well marked in the members of class
   A) Anthozoa B) Scyphozoa
   C) Sporozoa D) Hydrozoa
7. Which is correctly matched?
   A) Malaria-***Leishmania donovani*** B) Kalazar-***Glossina palpalis***
   C) Ascariasis-***Salmonella typhi*** D) Plague- ***Yersinia pestis***
8. How many of the given features are associated with taxonomical key and museum, respectively?

Ex-situ conservation, Analytical, Couplet, Preservation of specimen, Lead

   A) 3 & 3 B) 2 & 3
   C) 3 & 2 D) 3 & 1

9. The cells divide occasionally just to replace the cell that is lost due to injury or cell death, remains in
A) G_1 – phase B) G_0 – phase
C) M-phase D) G_2 – phase

10. Name of the nervous band connecting cerebral hemisphere in rabbit is:-
A) Corpus callosum B) Corpus striatum
C) Corpus albicans D) Corpus spongiosum

11. The characteristic larva of Ctenophora is
A) Cydippid B) Veliger
C) Nauplius D) Trochophore

12. The function of peroxisome is
A) to convert H_2O_2 into H_2O and O_2 B) utilisation of O_2 gas
C) to break toxic molecules of a cell D) All of the above

13. The differentiation of the cells occur in _____ stage
A) G_1 phase B) S phase
C) Quiescent stage D) Both (A) & (C)

14. Mollusca is :
A) Triploblastic, acoelomate B) Triploblastic, coelomate
C) Dibloblastic, acoelomate D) Diploblastic, coelomate

15. Antivenome for snake bite is manufactured at:-
A) Hofkin's research institute at Bombay B) C.D.R.I. Lucknow
C) I.F.R.I New Delhi D) C.S.W.R.I Avika Nagar

16. Which one is incorrect : –
A) New individuals replace the dead ones
B) Homeostatsis produces a self regulated steady state
C) Most homeostatic mechanisms operate through feed back systems
D) Cell obtains instructions for divisions from a hereditary protein

17. Comparing small and large cell, which statement is correct?
A) Small cells have a small surface area per volume ratio
B) Exchange rate of nutrients is fast with large cells
C) Small cells have a large surface area per volume ratio
D) Exchange rate of nutrients is slow with small cells

18. Animals active at day time are called
A) Nocturnal B) Herbivore
C) Diurnal D) Insectivore

19. Poison gland in poisonous Lizard is:-
A) Parotid gland B) Sub- maxillary gland
C) Infra orbital gland D) Sublingual gland

20. A somatic cell that has just completed the S-phase of its cell cycle, as compared to gamete of the same species has
A) twice the number of chromosomes and twice the amount DNA
B) same number of chromosomes, but twice the amount DNA
C) twice the number of chromosomes and four times the amount DNA
D) four times the number of chromosomes and twice the amount DNA

21. Which of the following is less general in characters
A) Species B) Family
C) Class D) Division

22. The causative agent of filaria is :
A) Wuchereria bancrofti
B) Leishmania donovani
C) Plasmodium vivax
D) Trypanosoma gambiens

23. Select the correct statement:-
A) Giraffe and rat have the same number of cervical vertebrate
B) Placenta and amnion both protect the embryo from mechanical shocks
C) Oxygenated blood is carried to all body parts by veins
D) Trypsin efficiently act in acidic medium

24. a. The (i) and (ii) may be traversed by plasmodesmata
b. The (iii) holds the different neighbouring (iv) cells together
c. In (v) cells, lipids like steroidal hormones are synthesised in (vi)
A) (i) Middle lamella; (ii) Secondary wall
B) (v) Animal cells; (vi) RER
C) (iii) Middle lamella; (iv) Plant
D) (ii) Primary wall; (v) Plant

25. Followings are the important events for telophase, **except**
A) Nucleolus, Golgi complex and ER reform
B) Nuclear envelope assembles around the chromosome clusters
C) Chromosomes cluster at opposite spindle poles
D) Chromosomes maintain their identity as discrete elements

26. Excretory organ of Spider is :
A) Coxal gland
B) Flame cells
C) Malpighian tubule
D) Nephridia

27. According to the fluid mosaic model of plasma membrane
A) Non-polar tails of phospholipids are towards cytoplasm
B) Quasi-fluid nature of lipids enables lateral movement of proteins within the overall bilayer
C) Peripheral proteins are partially or totally buried in the membrane
D) Both (a) & (b)

28. Pesticide used in preparation of herbarium specimen is
A) 2, 4-D
B) NAA
C) Mercuric chloride
D) Carbon di Sulphide

29. Which of the following statements is **not correct** w.r.t. lysosomes?
A) Autophagic vacuoles are also called suicidal bags
B) They are rich in hydrolytic enzymes like lipases, proteases and carbohydrases
C) Polynephritis may occur due to absence of ephagy from residual bodies
D) These are responsible for the packaging of materials and transport

30. One of the following is polymorphic
A) Taenia solium
B) Trypanosoma
C) Paramecium
D) Entamoeba

31. Mouth part of mosquitoes is :
A) Sucking and piercing type
B) Sponging type
C) Biting and chewing type
D) None of these

32. Choose the **incorrect** match w.r.t. mitosis.
A) Metaphase – Study of morphology of chromosome
B) Anaphase – Poleward movement of chromatids
C) Prophase – Shortest phase

D) Telophase – Final stage of mitotic karyokinesis

33. Which of the following is **incorrect** w.r.t. features of life forms?
A) Self-consciousness – Human being
B) Sexual reproduction – Worker honey bee
C) Consciousness – All living organisms
D) Growth – Characteristic feature

34. Connecting link between reptiles and birds is:-
A) Dodo B) Archaeopteryx
C) Rhea D) Sphenodon

35. Hydra is a coelenterate because it has
A) Tentacles B) Mesogloea
C) Coelenteron and cnidoblast D) Hypostome

36. The fluid nature of the cell membrane is important from the point of view of functions like
a. Cell division b. Secretion c. Cell growth
A) Only a B) Only b
C) Only b & c D) All a, b & c

37. Identify the **wrong** match

Organism		**Asexual Reproduction**
A) Protonema of mosses	–	Fragmentation
B) *Planaria*	–	True regeneration
C) Hydra	–	Sporulation
D) Bacteria	–	Fission

38. Peripetus is a connecting between :
A) Aves and fishes B) Reptiles and birds
C) Fishes and amphibians D) Arthropods and annelids

39. Furculum, synsacrum and pygostyle bones are characteristic of:-
A) Snakes B) Lizard
C) Birds D) Monotremes

40. Fill in the blanks and choose the **correct** option.
a) (i) takes into account evolutionary relationship between organisms along with classification.
b) (ii) the category, (iii) is the difficulty of determining the relationship to other taxa at the same level.
c) (iv) often have collections of animal skeletons.

	(i)	**(ii)**	**(iii)**	**(iv)**
A)	Taxonomy	Lower	Greater	Herbarium
B)	Systematics	Higher	Greater	Museum
C)	Classification	Higher	Less	Botanical gardens
D)	Taxonomy	Lower	More	Zoological parks museum

41. Nuclear membrane is derivate of
A) SER B) RER
C) Microtubules D) Golgi complex

42. Silver fish is a
A) Fish B) Crustacean
C) Cnidarian D) Insect

43. An example of biolumnicent protozoan is
A) Noctiluca B) Ceratium
C) Both A) & B) D) None of these

44. The important cell organelles responsible for the formation of glycoproteins and glycolipids
A) Is responsible for synthesis of celluar energy
B) Is the largest organelle of plant cell
C) Was first observed by Camillo Golgi
D) Is minute membrane bound vesicles called microbodies

45. Echinodermata is a group of animals which are:
A) Coelomate, horny, marine B) Coelomate, spiny, marine
C) Acoelomate, spiny, fresh water D) Joint legged, marine

46. Crossing over occurs between
A) Sister chromatids of homologous chromosomes
B) Non-sister chromatids of non-homologous chrmosomes
C) Non-sister chromatids of homologous chromosomes
D) Sister chromatids of non-homologous chromosomes

47. Eukaryotic cell differs from prokaryotic cell in having
A) Plasmids
B) Single envelope system
C) Only 70S types of ribosomes
D) True vacuoles, cytoskeleton and true nucleus

48. African sleeping sickness is caused by :
A) Trypanosoma B) Leishmania
C) Latimeria D) Plasmodium

49. The unique feature of Bryophytes compared to other green plant groups is that:-
A) They produce spores
B) They lack vascular tissue
C) They lack root
D) Their sporophyte is attached to gametophyte

50. Match the following columns and select the **correct** option.

Column I	**Column II**
a. S-phase	(i) Duplication of mitochondria
b. M-phase	(ii) Phase between mitosis and initiation of DNA replication
c. G_1-phase	(iii) Centriole duplicates in the cytoplasm of animal cells
d. G_2-phase	(iv) Shortest phase of cell cycle

A) a(iv), b(i), c(ii), d(iii) B) a(iii), b(iv), c(ii), d(i)
C) a(iii), b(ii), c(iv), d(i) D) a(ii), b(iii), c(iv), d(i)

51. Steroidal hormones are synthesised in which of the following cell organelle of the animal cells?
A) RER B) SER
C) Golgi apparatus D) Lysosomes

52. In Bryophytes diploid number of chromosomes occur in:-
A) Gametes B) Spores
C) Spore mother cells D) Nuclei of gametes

53. Which of the following is saprophytic bryophytes:-
A) Bauxbaumia B) funaria
C) Anthoceros D) polytricum

54. The centromere is present very close to one end of the chromosome in
A) Telocentric chromosome B) Sub-metacentric chromosome
C) Acrocentric chromosome D) Metacentric chromosome

55. Centrioles are found in :
A) All prokaryotic cells B) Higher plant cells
C) Animal cells and fungal cells D) Animal cells only

56. Which of the following is example of moss
A) Funaria B) Riccia
C) Anthoceros D) Pellia

57. The cell wall of Fungi is composed of:-
A) Chitin B) Cellulose
C) Mucopeptide D) Pseudomurin

58. Select the **correct** option stating true (T) and false (F) w.r.t. ribosomes
i) Protein synthesis in eukaryotic cell occurs on the ribosomes in nucleus
ii) Ribosomes are the granular structures first observed under the electron microscope by Palade
iii) The sedimentation coefficient is indirect measure of density and size.

	(i)	(ii)	(iii)
A)	T	T	T
B)	F	F	F
C)	T	F	T
D)	F	T	T

59. Metabolic reactions can be demonstrated outside the body in cell-free system. The isolated metabolic reactions *in-vitro* are
A) Living things B) Non-living things
C) Living reactions D) Non-living reactions

60. Which of the following is a correct name :
A) Solanum luberosum B) Solanum Tuberosum
C) Solanum luberosum Linn. D) All the above

61. Which of the following is commonly known "Chilgoza pine"
A) Pinus roxburghii B) P. strobus
C) P. gerardiana D) P. Sylvestris

62. In scientific name of mango
A) *Mangifera* is specific epithet
B) Author name appear after *indica*
C) Both parts of the name are underlined together
D) Name is derived either from Latin or Greek irrespective of their origin.

63. Glycogen is reserve food in all, **except**
A) Plants B) Fungi
C) Bacteria D) Animals

64. Phylogeny refers to
A) Natural classification B) Evolutionary classification
C) Evolutionary history D) Origin of algae

65. Archaebacteria differ from other bacteria in having a:-
A) Different cell wall structure
B) Different cellular organization
C) Parasitic nature
D) All of these

66. Cytoskeleton is involved in
A) Motility
B) Maintenance of the shape & internal organisation
C) Both (A) and (B)
D) Peptide synthesis

67. The cells divide occasionally just to replace the cell that is lost due to injury or cell death, remains in
A) G_1 – phase
B) G_0 – phase
C) M-phase
D) G_2 – phase

68. Life cycle of gymnosperm is
A) Haplontic
B) Haplodiplontic
C) Diplontic
D) Diplohaplontic

69. Select true statement
A) Viruses are obligate parasites
B) In Lichens, algal component is called phycobiont
C) In Lichens, Fungal component is called mycobiont
D) All the above

70. Acrosome of the sperm is a modified
A) Endoplasmic reticulum
B) Mitochondria
C) Golgi apparatus
D) Lysosomes

71. Which of the following statement is **incorrect** w.r.t. fluid mosaic model of plasma membrane?
A) Integral proteins are partially or totally buried in the membrane
B) The non-polar tail of unsaturated hydrocarbons is protected from the aqueous environment
C) Removal of tunnel proteins requires crude methods of treatments like detergents
D) The membrane of RBC has approximately 52 percent proteins and 40 percent lipids.

72. Photosynthetic pigments common to all algae
A) Chlorophyll 'b' and carotene
B) Chlorophyll 'a' and 'b'
C) Chlorophyll 'a' and carotene
D) Chlorophyll and xanthophylls

73. The botanical name of "Sanjeevani"s
A) Selaginella utricularia
B) Selaginella bryopteris
C) Selaginella crotalaria
D) Selaginella botardia

74. Which of the following statements is/are **wrong** w.r.t cell cycle?
i - M-phase lasts more than 95% duration of cell cycle
ii - In human cells, the average duration of cell cycle is 24 hour
iii - Cells are metabolically active during G_0 stage.
iv - Chromosome number is double in S-phase
A) Only (i) B) (i) & (ii) C) (ii) & (iii) D) (i) & (iv)

75. Dictyosome is absent in
A) cyanobacteria
B) *Myscoplasma*
C) bacteria
D) All of these

76. "Agar-agar" is obtained from :-
A) Green Algae B) Red Algae
C) Brown Algae D) Yellow green

77. A flask shaped fruiting body of Ascomycetes called:-
A) Sclerotium B) Apothecium
C) Cleistothecium D) Perithecium

78. Select the **incorrect** match.
A) Crossing over - Pachytene
B) Synthesis of histone - G_2 phase
C) Synapsis - Zygotene
D) Synthesis of nucleotides - G_1 phase

79. Which of the following serves as mitotic spindle posion?
A) Ca^{2+} B) Mg^{2+}
C) Tubulin D) Colchicine

80. Green algae are considered as ancestors of higher plants due to their resemblance with higher plants in
A) Pigments B) Cell wall
C) Stored food D) All the above

81. Which organism is responsible for red surface of sea
A) Euglena B) Gonyaulax
C) Amoeba D) Paramecium

82. Phragmoplast is
A) proplastid in cytoplasm of dividing cells
B) cell plate formed by vesicles of ER and dictyosomes during cytokinesis
C) array of spindle fibre at equator
D) None of the above

83. Find the correct statement.
A) During mitosis, endoplasmic reticulum and nucleous disapper completely at early prophase
B) Chromosomes are arranged along the equator during prophase of mitosis
C) Chromosomes is made up of two sister chromatids at anaphase of mitosis
D) Small disc-shaped structures at the surface of centromeres that appear during early metaphase are kinetochores

84. Evolution of seed habit first started in
A) Selaginella like ancestral pteridophytes B) Psilotum like ancestral pteridophytes
C) Gymnosperms D) Mosses

85. Which is commonly called "Drosophilla of plant kingdom"
A) Morchella B) Neurospora
C) Rhizopus D) Claviceps

86. First act in taxonomy is
A) Description B) Identification
C) Nomenclature D) Classification

87. How many chromosomes will be present in the cell at prophase and after M Phase respectively, if it has 20 chromosomes in meristematic cell?
A) 10, 40 B) 40, 40
C) 20, 20 D) 10, 20

88. In pteridophytes, reduction division takes place in
A) Zygote
B) Spore mother cells
C) Gametangia
D) Prothallus

89. Change in colour of algae according to depth in sea is called
A) Bohr's effect
B) Gaudikovs effect
C) Fogg's effect
D) Pasteur effect

90. Reserve food of algae and fungi are
A) Starch and soluble floridoside
B) Oil droplets and fats
C) Starch and glycogen
D) Starch and Glycerol

(**SINGLE CORRECT ANSWER TYPE**)

This section contains 45 multiple choice questions. Each question has 4 options A), B), C) and D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

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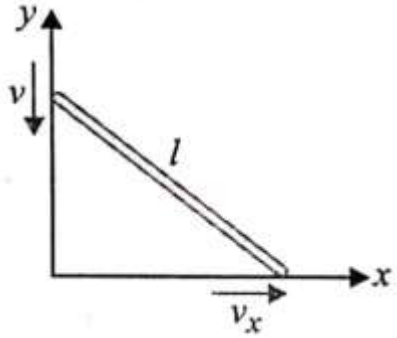
91. A particle starts from origin and is moving in *XY*-plane whose velocity is $v = by\,\hat{i} + v_0\,\hat{j}$. The trajectory of particle is (b, v_0 are constant, x and y are position coordinates at time t)

A) straight line
B) circle
C) parabola
D) hyperbola

92. A rod of length l leans by its upper end against a smooth vertical wall, while its other end leans against the floor. The end that leans against the wall moves uniformly downward. Then

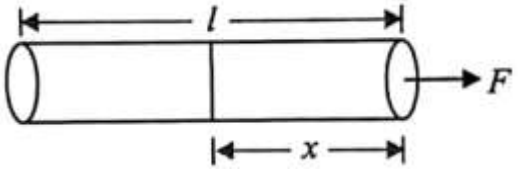


A) the other end also moves uniformly
B) the speed of other end goes on decreasing
C) the speed of other end goes on increasing
D) the speed of other end first decreases and then increases

93. A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If the total time elapsed it t, the maximum velocity acquired by the car is given by

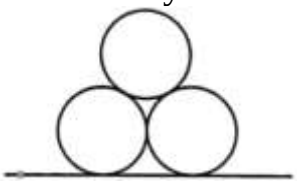
A) $\left(\frac{\alpha^2+\beta^2}{\alpha\beta}\right)t$
B) $\left(\frac{\alpha^2-\beta^2}{\alpha\beta}\right)t$
C) $\left(\frac{\alpha+\beta}{\alpha\beta}\right)t$
D) $\left(\frac{\alpha\beta}{\alpha+\beta}\right)t$

94. A uniform rope of length l is pulled by a constant force F as shown. The tension in the rope at distance x from the end where force is applied is



A) F
B) $F\left(1+\frac{x}{l}\right)$
C) $F\frac{x}{l}$
D) $F\left(1-\frac{x}{l}\right)$

95. Three identical billiard balls each of mass 1 kg are placed as shown in the figure. The upper ball is smooth. Find minimum coefficient of static friction between lower balls and ground, so that balls remain stationary.



A) $\frac{1}{\sqrt{3}}$ B) $\frac{1}{3\sqrt{3}}$

C) $\frac{2}{\sqrt{3}}$ D) $0 \cdot 5$

96. An iron chain of length L lies on a rough table. The coefficient of friction between the chain and the table is μ. What maximum fraction of the chain can hang from the edge of the table?

A) $\frac{\mu+1}{\mu}$ B) $\frac{1-\mu}{\mu}$

C) $\frac{\mu}{\mu+1}$ D) $\frac{\mu}{1-\mu}$

97. A particle of mass m is projected with velocity u at an angle α with horizontal. During the period when the particle descends from highest point to the position where its velocity vector makes an angle $\frac{\alpha}{2}$ with horizontal. Work done by gravity force is

A) $\frac{1}{2}mu^2\tan^2\alpha$ B) $\frac{1}{2}mu^2\tan^2\frac{\alpha}{2}$

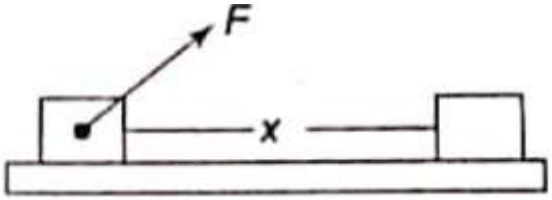
C) $\frac{1}{2}mu^2\cos^2\alpha\tan^2\frac{\alpha}{2}$ D) $\frac{1}{2}mu^2\cos^2\frac{\alpha}{2}\sin^2\alpha$

98. A boy weighing 50 kg finished long jump at a distance of 8 m. Considering that he moved along a parabolic path and his angle of jump was 45°, his initial KE will be: $g = 9.8\text{m/s}^2$

A) 960 J B) 1560 J

C) 2460 J D) 1960 J

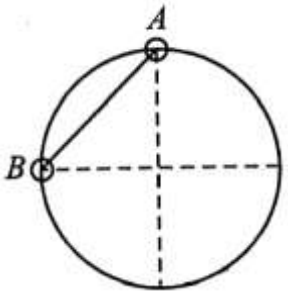
99. A block of mass m is pulled slowly by a minimum constant force on a horizontal surface through a distance x. The coefficient of kinetic friction is μ. Find the work done by force F.



A) $\frac{\mu mgx}{1+\mu^2}$ B) $\frac{\mu mgx}{1-\mu^2}$

C) $\frac{\mu mgx}{\sqrt{1+\mu^2}}$ D) None of these

100. Two beads *A* and *B* of equal mass *m* are connected by a light inextensible cord. They are connected to move on a frictionless ring in vertical plane. The beads are released from rest as shown. The tension in the cord just after the release is



A) $\sqrt{2}\,mg$ B) $\frac{mg}{2}$

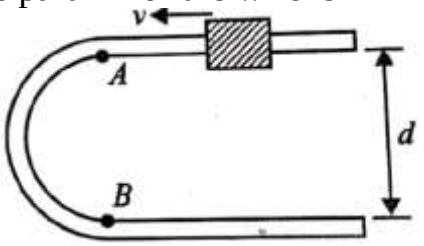
C) $\frac{mg}{4}$ D) $\frac{mg}{\sqrt{2}}$

101. A man standing on the roof of a house of height *h* throws one particle vertically downwards and another particle horizontally with the same velocity *u*. The ratio of their velocities when they reach the earth's surface will be

A) $\sqrt{2gh+u^2} : u$ B) $1:2$

C) $1:1$ D) $\sqrt{2gh+u^2} : \sqrt{2gh}$

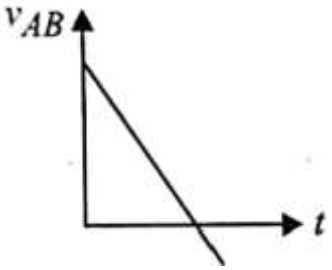
102. A fixed *U*-shaped smooth wire in a horizontal plane has a semi-circular bending between A and B as shown in figure. A bead of mass *m* moving with uniform speed *v* through the wire enters the semicircular bend at *A* and leaves at *B*. The average force exerted by the bead on the part *AB* of the wire is

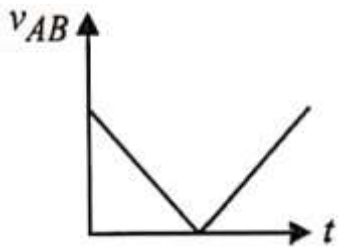


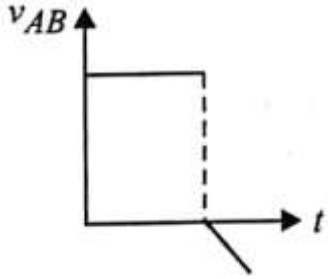
A) $\frac{2mv^2}{\pi d}$ B) $\frac{4mv^2}{\pi d}$

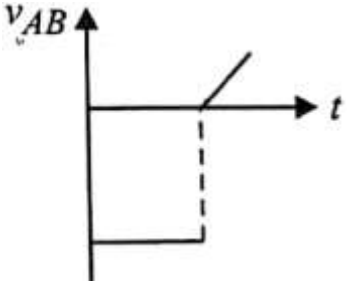
C) 0 D) none of these

103. A body A is thrown vertically upwards with such a velocity that it reaches a maximum height of *h*. Simultaneously, another body *B* is dropped from height *h*. It strikes the ground and does not rebound. The velocity of *A* relative to *B* versus time graph is best represented by (upward direction is positive)

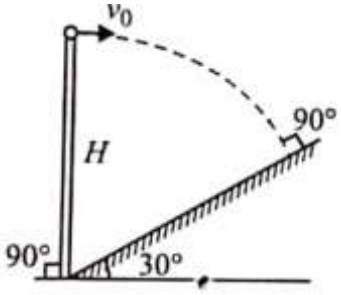
A) 

B) 

C) 

D) 

104. In figure the angle of inclination of the inclined plane is 30°. Find the horizontal velocity v_0 so that the particle hits the inclined plane perpendicularly.



A) $v_0 = \sqrt{2\,gH/5}$ B) $v_0 = \sqrt{2\,gH/7}$

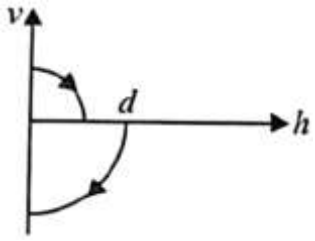
C) $v_0 = \sqrt{gH/5}$ D) $v_0 = \sqrt{gH/7}$

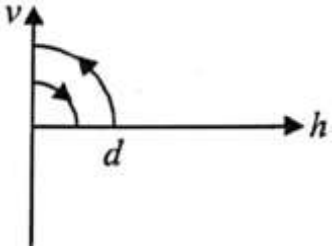
105. A block is allowed to slide down a smooth inclined plane of inclination θ. If the inclined plane is lying on the floor of a lift which is falling down with a retardation *a*, what will be the acceleration of the block with which it will slide down?

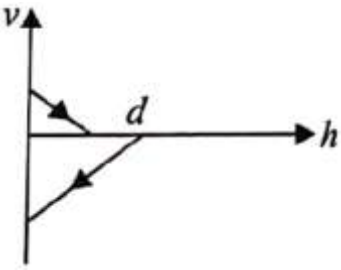
A) $(g+a)\sin\theta$ B) $(g-a)\sin\theta$

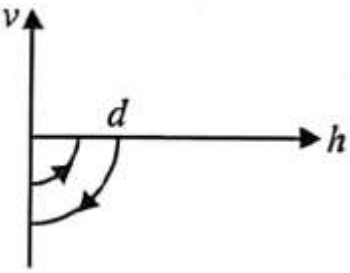
C) $g\sin\theta + a$ D) $g\sin\theta - a$

106. A ball is dropped vertically from a height *d* above the ground. It hits the ground and bounces up vertically to a height *d*/2. Neglecting subsequent motion and the air resistance, its velocity *v* with height *h* above the ground can be represented as

A) 

B) 

C) 

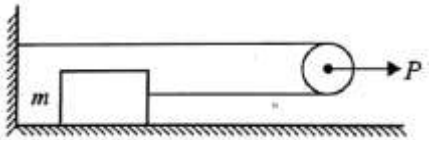
D) 

107. A ball is thrown from a height of h meter with an initial downward velocity v_0. It hits the ground, loses half of its kinetic energy and bounces back to the same height. The value of v_0 is

A) $\sqrt{2gh}$ B) $\sqrt{gh}$

C) $\sqrt{3gh}$ D) $\sqrt{2.5gh}$

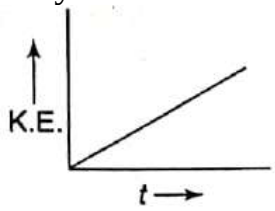
108. In the figure, a massless pulley is pulled by a constant force of magnitude *P*. There is no friction between the block and the floor. The acceleration produced in the block of mass *m* is



A) P/m B) $P/2m$

C) $P/3m$ D) $P/4m$

109. The kinetic energy of a body moving along a straight line varies with time as shown in figure. The force acting on the body:



A) zero B) constant

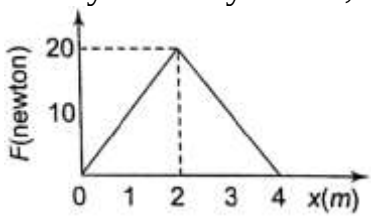
C) directly proportional to velocity D) inversely proportional to velocity

110. A very broad elevator is going up vertically with a constant acceleration of 2m/s^2. At the instant when its velocity is 4m/s a ball is projected from the floor of the lift with a speed of 4 m/s relative to the floor at an elevation of 30°. Time taken by the ball to return the floor is ($g = 10\text{m/s}^2$)

A) $\frac{1}{2}\text{s}$ B) $\frac{1}{3}\text{s}$

C) $\frac{1}{4}\text{s}$ D) 1s

111. The graph between the resistive force *F* acting on a body and the distance covered by the body is shown in the figure. The mass of the body is 25 kg and initial velocity is 2 m/s. When the distance covered by the body is 4 m, its kinetic energy would be



A) 50 J B) 40 J

C) 20 J D) 10 J

112. The power of a water pump is 2 kW. If $g = 10\text{ms}^{-2}$, the approximate amount of water it can raise in one minute to a height of 10 m is

A) 2000 litres B) 500 litres

C) 100 litres D) 1200 litres

113. A block of mass 2 kg is placed on a frictionless surface. It is struck by a jet releasing water at a rate of 1 kg/s and with a speed of 5 m/s. Assuming that after striking the block, the velocity of water is reduced to zero, the acceleration of the block will be

A) 5ms^{-2} B) 4ms^{-2}

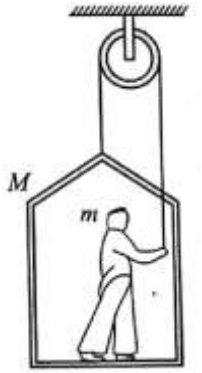
C) $2\cdot5\text{ms}^{-2}$ D) $2\ \text{ms}^{-2}$

114. The displacement x of a particle moving in one dimension under the action of a constant force is related to the time t by the equation $t = \sqrt{x} + 3$, where x is in meters and t is in seconds. The work done by the force in the first 6 seconds is

A) 9 J B) 6J

C) 0 J D) 3 J

115. A man of mass m stands on a frame of mass M. He pulls on a light rope, which passes over a pulley. The other end of the rope is attached to the frame. For the system to be in equilibrium, what force must the man exert on the rope?



A) $\frac{1}{2}(M+m)g$ B) $(M+m)g$

C) $(M-m)g$ D) $(M+2m)g$

116. A particle is placed at rest inside a hollow hemisphere of radius R. The coefficient of friction between the particle and the hemisphere is $\mu = \frac{1}{\sqrt{3}}$. The maximum height up to which the particle can remain stationary is

A) $\frac{R}{2}$ B) $\left(1 - \frac{\sqrt{3}}{2}\right)R$

C) $\frac{\sqrt{3}}{2}R$ D) $\frac{3R}{8}$

117. A fire man of mass 60 kg slides down a pole. He is pressing the pole with a force of 600 N. The coefficient of friction between the hands and the pole is 0.5. With what acceleration will the fire man slide down? (Take $g = 10\,\text{ms}^{-2}$)

A) $10\ \text{ms}^{-2}$ B) $5\ \text{ms}^{-2}$

C) $2 \cdot 5\ \text{ms}^{-2}$ D) $1\ \text{ms}^{-2}$

118. One end of a spring balance is stretched by a force of 2N and an equal and opposite force is applied on its other end. The reading of the spring balance will be

A) 4 N B) 2 N

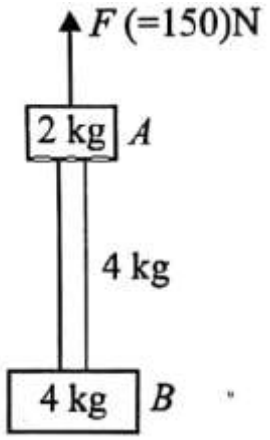
C) 1N D) 0

119. A ball is thrown from the ground to clear a wall 3 m high at a distance of 6 m and falls 18 m away from the wall, the angle of projection of ball is

A) $\tan^{-1}\left(\frac{3}{2}\right)$ B) $\tan^{-1}\left(\frac{2}{3}\right)$

C) $\tan^{-1}\left(\frac{1}{2}\right)$ D) $\tan^{-1}\left(\frac{3}{4}\right)$

120. Consider the arrangement shown where two blocks are connected by a uniform rope of mass 4 kg. The arrangement is lifted up vertically by vertical upward force of 150 N magnitude. The ratio of tension in the rope at *A* to that at *B* would be



A) 2 B) 1/2
C) 5/4 D) 4/3

121. A block of mass *m* is placed at rest on a horizontal rough surface with angle of friction ϕ. The block is pulled with a force *F* at angle θ with the horizontal. The minimum value of *F* required to move the block is

A) $\frac{mg\sin\phi}{\cos(\theta-\phi)}$ B) $\frac{mg\cos\phi}{\cos(\theta-\phi)}$

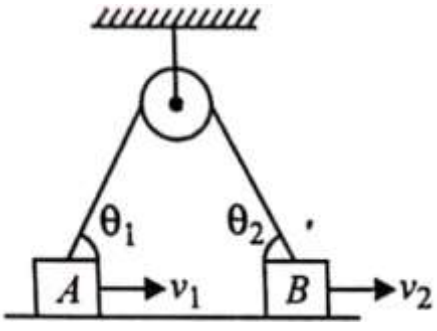
C) $mg\tan\phi$ D) $mg\sin\phi$

122. The kinetic energy of a particle moving along a straight line increases uniformly with respect to the distance travelled by it. The force acting on the particle is (*v* is the speed of particle at any time)

A) constant B) proportional to *v*

C) proportional to v^2 D) inversely proportional to *v*

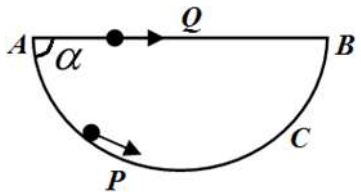
123. In figure blocks A and B move with velocities v_1 and v_2 along horizontal direction. Find the ratio of v_1/v_2.



A) $\frac{\sin\theta_1}{\sin\theta_2}$ B) $\frac{\sin\theta_2}{\sin\theta_1}$

C) $\frac{\cos\theta_2}{\cos\theta_1}$ D) $\frac{\cos\theta_1}{\cos\theta_2}$

124. A particle *P* is sliding down a frictionless hemispherical bowl. It passes the point *A* at $t = 0$. At this instant of time, the horizontal component of its velocity is *v*. A bead *Q* of the same mass as *P* is ejected from *A* at $t = 0$ along the horizontal string *AB*(see figure) with the speed *v*. Friction between the bead and the string may be neglected. Let t_p and t_Q be the respective time taken by *P* and *Q* to reach the point *B*. Then.



A) $t_p < t_Q$ B) $t_p = t_Q$

C) $t_p > t_Q$ D) All of these

125. A running man has half the kinetic energy than a boy of half his mass has. The man speeds up by 1 m/sec and then has the same kinetic energy as the boy. What were the original speeds of man and boy respectively?

A) $2.4\text{ms}^{-1}, 4.8\text{ms}^{-1}$ B) $2.4\text{ms}^{-1}, 3.4\text{ms}^{-1}$

C) $3.4\text{ms}^{-1}, 4.8\text{ms}^{-1}$ D) $3.4\text{ms}^{-1}, 6.8\text{ms}^{-1}$

126. Starting from rest, a body slides down a 45° inclined plane in twice the time it takes to slide the same distance in the absence of friction. What is the coefficient of friction between the body and the inclined plane?

A) $1/4$ B) $1/2$

C) $3/4$ D) $\sqrt{3}/2$

127. Two springs *A* and *B* are identical except that *A* is stiffer than *B* i.e., $k_A > k_B$. If the two springs are stretched by the same force, then

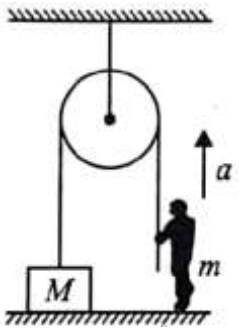
A) more work is done on *B* i.e., $W_B > W_A$

B) more work is done on *A*, i.e., $W_A > W_B$

C) work done on *A* and *B* are equal

D) work done depends upon the way in which they are stretched

128. In figure, the block of mass *M* is at rest on the floor. The minimum acceleration with which a boy of mass *m* should climb along the rope of negligible mass so as to lift the block from the floor is



A) $\left(\frac{M}{m}+1\right)g$ B) $\left(\frac{M}{m}-1\right)g$

C) $\frac{M}{m}g$ D) $> \frac{M}{m}g$

129. A mass of 50 kg is raised through a certain height by a machine whose efficiency is 90%; the energy spent is 5000 J. If the mass is now released, its *KE* on hitting the ground shall be:

A) 5000 J B) 4500 J

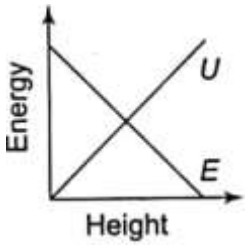
C) 4000 J D) 5500 J

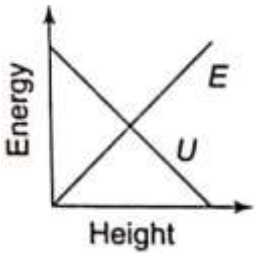
130. The retardation experienced by a moving motor-boat after its engine is cut off, is given by $\frac{dv}{dt} = -kv^3$, where *k* is a constant. If v_0 is the magnitude of the velocity at cut-off, the magnitude of the velocity at a time *t* after the cut-off is

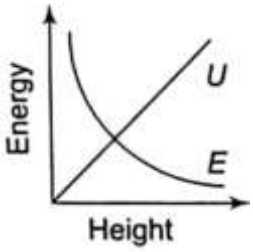
A) $v_0/2$ B) v_0

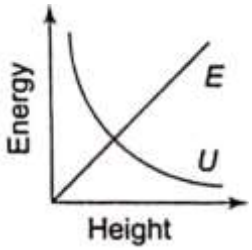
C) $v_0 e^{-kt}$ D) $\frac{v_0}{\sqrt{2v_0^2kt+1}}$

131. Which of the following graphs is correct between kinetic energy (*E*), potential energy (*U*) and height (*h*) from the ground of the particle

A) 

B) 

C) 

D) 

132. A block A of mass 1 kg is projected along rough horizontal surface from $x = 0$ with speed $v_0 = \sqrt{10}$ m/s. Find the distance travelled by block before coming to rest. The coefficient of kinetic friction between block and the surface is $\mu = bx$, where $b = 1\ \text{m}^{-1}$. ($g = 10\ \text{m/s}^2$)

A) 1 m B) 2 m

C) 3 m D) 4 m

133. The point from where a ball is projected is taken as the origin of the co-ordinate axes. The *x* and *y* components of its displacement are given by $x = 6t$ and $y = 8t - 5t^2$. What is the velocity of projection?

A) $6\,\text{ms}^{-1}$ B) $8\,\text{ms}^{-1}$

C) $10\ \text{ms}^{-1}$ D) $14\ \text{ms}^{-1}$

134. A block of mass M is kept at rest on a rough inclined plane of inclination θ with horizontal. The magnitude and direction of total reaction from the inclined plane on the block is

A) $Mg\sin\theta$ down the incline
B) less than $Mg\sin\theta$ down the incline
C) Mg upwards
D) Mg downwards

135. A body is sliding down an inclined plane under its own weight at constant speed. If the inclination of the plane to the horizon is 30°, the angle of friction is

A) 30°
B) 60°
C) 45°
D) 15°

(**SINGLE CORRECT ANSWER TYPE**)

This section contains 45 multiple choice questions. Each question has 4 options A), B), C) and D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and –1 in all other cases.

136. The radii of the first Bohr orbit of $H_{(r_H)}, He^{+}_{(r_{He^+})}$ and $Li^{2+}_{(r_{Li^{2+}})}$ are in the order:

A) $r_{He^+} > r_H > r_{Li^{2+}}$ B) $r_H < r_{He^+} < r_{Li^{2+}}$

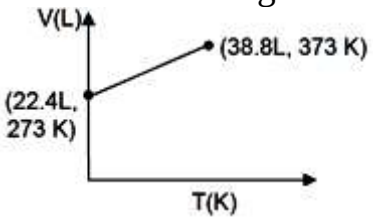
C) $r_H > r_{He^+} < r_{Li^{2+}}$ D) $r_{He^+} < r_H < r_{Li^{2+}}$

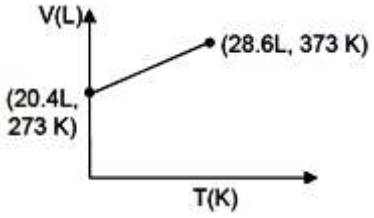
137. Number of molecules in 100 mL of each of O_2, NH_3 and CO_2 at STP are

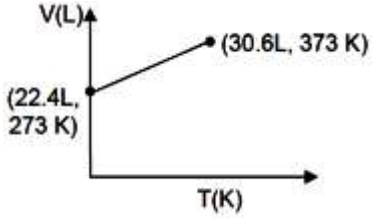
A) in the order $CO_2 < O_2 < NH_3$ B) in the order $NH_3 < O_2 < CO_2$

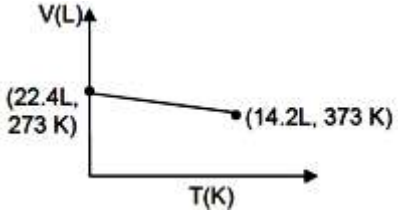
C) the same D) $NH_3 = CO_2 < O_2$

138. Which of the following volume (*V*), temperature (*T*) plots represents the behaviour of one mole of an ideal gas at one atmosphere?

A) 

B) 

C) 

D) 

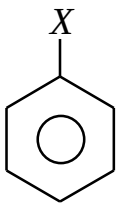
139. A gas cannot be liquefied if:

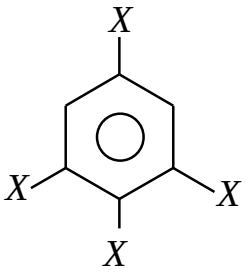
A) forces of attraction are low under ordinary conditions

B) forces of attraction are high under ordinary conditions

C) forces of attraction are zero under ordinary conditions

D) forces of attraction either high or low under ordinary conditions

140. Dipole moment of 

is 1.5 D. The dipole moment of 

is

A) 1.5 D B) 2.25 D

C) 1 D D) 3 D

141. Which of the following statements is correct

A) SF_4 is polar and non-reactive B) SF_6 is non-polar and very reactive

C) SF_6 is a strong fluorinating agent

D) SF_4 is prepared by fluorinating SCl_2 with NaF

142. Match Column I with Column II and select the correct answer using the codes given below.

Column I (Successive IE				Column II (Elements)	
	IE_1	IE_2	IE_3		
A.	1312	–	–	**1.**	H
B.	520	7297	11810	**2.**	Li
C.	900	1758	14810	**3.**	Be
D.	800	2428	3660	**4.**	B

Codes:

	A	**B**	**C**	**D**
A)	2	1	4	3
B)	3	4	2	1
C)	4	3	1	2
D)	1	2	3	4

143. The bond angle in H_2S (for $H—S—H$) is:

A) same as that of $Cl—Be—Cl$ in $BeCl_2$

B) greater than $H—N—H$ bond angle in NH_3

C) greater than $H—Se—H$ and less than $H—O—H$

D) same as $Cl—Sn—Cl$ in $SnCl_2$

144. In BrF_3 molecule, the lone pairs occupy equatorial positions to minimize

A) Lone pair-lone pair repulsion and lone pair-bond pair repulsion

B) Lone pair-lone pair repulsion only

C) Lone pair- bond pair repulsion only

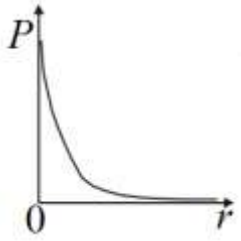
D) Bond pair- bond pair repulsion only

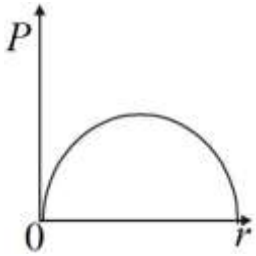
145. *n g* of substance *X* reacts with *m g* of substance *Y* to form *P g* of substance *R* and *q g* of substance *S*. This reaction can be represented as, $X + Y = R + S$. The relation which can be established in the amounts of the reactants and the products will be

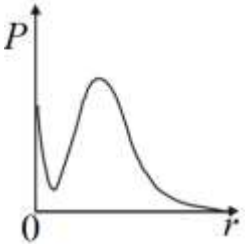
A) $n - m = p - q$ B) $n + m = p + q$

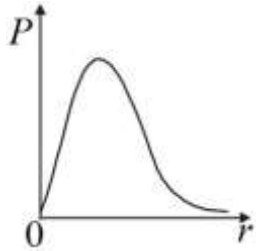
C) $n = m$ D) $p = q$

146. *P* is the probability of finding the 1*s* electron of hydrogen atom in a spherical shell of infinitesimal thickness, *dr*, at a distance *r* from the nucleus. The volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of *P* on *r* is:

A) 

B) 

C) 

D) 

147. Which of the following transformation requires least energy?

A) $F^-_{(g)} \rightarrow F_{(g)} + e^-$ B) $P^-_{(g)} \rightarrow P_{(g)} + e^-$

C) $S^-_{(g)} \rightarrow S_{(g)} + e^-$ D) $Cl^-_{(g)} \rightarrow Cl_{(g)} + e^-$

148. 1 litre of N_2 and 7/8 litre of O_2 at the same temperature and pressure were mixed together. What is the relationship between the masses of the two gases in the mixture?

A) $M_{N_2} = 2M_{O_2}$ B) $M_{N_2} = 8M_{O_2}$

C) $M_{N_2} = M_{O_2}$ D) $M_{N_2} = 16M_{O_2}$

149. Give the correct order of initials **T** or **F** for following statements. Use **T** if statement is true and **F** if it is false :

(I) The order of repulsion between different pair of electrons is $l_p - l_p > l_p - b_p > b_p - b_p$

(II) In general, as the number of lone pair of electrons on central atom increases, value of bond angle from normal bond angle also increases

(III) The number of lone pair on O in H_2O is 2 while on N in NH_3 is 1

(IV) The structure of xenon fluorides and xenon oxyfluorides could not be explained on the basis of VSEPR theory

A) TTTF B) TFTF

C) TFTT D) TFFF

150. An aqueous solution of 6.3 g of oxalic acid dihydrate is made up to 250 ml. The volume of 0.1 N NaOH required to completely neutralise 10 ml of this solution is

A) 40 ml B) 20 ml

C) 10 ml D) 4 ml

151. With the increasing principal quantum number, the energy difference between adjacent energy levels in H-atom

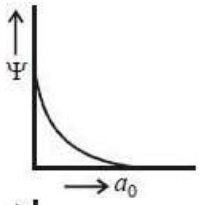
A) decreases

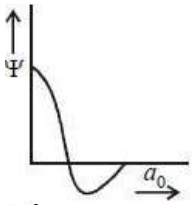
B) increases

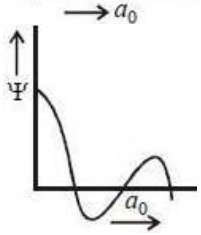
C) remains constant

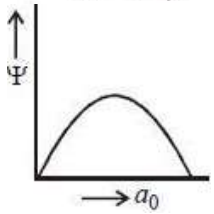
D) decreases for low values of Z and increases for higher values of Z.

152. Which of the following graph correspond to one node

A) 

B) 

C) 

D) 

153. The compressibility of a gas is less than unity at STP. Therefore:

A) $V_m > 22.4$ litre B) $V_m < 22.4$ litre

C) $V_m = 22.4$ litre D) $V_m = 44.8$ litre

154. Match the compounds given in column I with the hybridization and shape given in column II and mark the **correct** option

	Column-I		**Column-II**
(a)	XeF_6	(i)	Distorted octahedral
(b)	XeO_3	(ii)	Square planar
(c)	$XeOF_4$	(iii)	Pyramidal
(d)	XeF_4	(iv)	Square pyramidal

Code :

	(a)	**(b)**	**(c)**	**(d)**
A)	(i)	(iii)	(iv)	(ii)
B)	(i)	(ii)	(iv)	(iii)
C)	(iv)	(iii)	(i)	(ii)
D)	(iv)	(i)	(ii)	(iii)

155. Which one of the following conversion involve change in both hybridization and shape

A) $CH_4 \rightarrow C_2H_6$ B) $NH_3 \rightarrow NH_4^+$

C) $BF_3 \rightarrow BF_4^-$ D) $H_2O \rightarrow H_3O^+$

156. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of

A) $Li_2 < Li_2^+ < Li_2^-$ B) $Li_2^- < Li_2^+ < Li_2$

C) $Li_2 < Li_2^- < Li_2^+$ D) $Li_2^- < Li_2 < Li_2^+$

157. N_2 and O_2 are converted into monoanions N_2^- and O_2^- respectively, which of the following statements is wrong

A) In N_2, $N-N$ bond weakens B) In O_2, the $O-O$ bond order increases

C) In O_2, bond length increases D) N_2^- becomes diamagnetic

158. Which is correct statement?

As the *s*-character of a hybrid orbital decreases

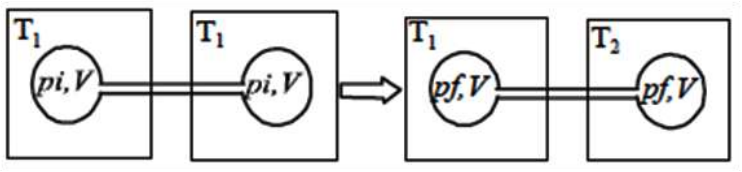
(I) The bond angle decreases (II) The bond strength increases

(III) The bond length increases (IV) Size of orbtials increases

A) (I), (III) and (IV) B) (II), (III) and (IV)

C) (I) and (II) D) All are correct

159. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure p_i and temperature T_1 are connected through a narrow tube of negligible volume as shown in the fig. Below. The temperature of one of the bulbs is then raised to T_2. The final pressure p_f is:



A) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$ B) $2p_i\left(\frac{T_2}{T_1+T_2}\right)$

C) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$ D) $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

160. When photons of energy 4.25eV strike the surface of a metal *A*, the ejected photoelectrons have maximum kinetic energy, T_A (expressed in eV) and de Broglie wavelength λ_A, the maximum kinetic energy of photoelectrons liberated from another metal *B* by photons of energy 4.70V is $T_B = T_A - 1.50eV$. If the de Broglie wavelength of these photoelectrons is $\lambda_B = 2\lambda_A$, then which is not correct?

A) The work function of *A* is 2.25 eV B) The work function of *B* is 3.70 eV

C) $T_A = 2.00\,\text{eV}$ D) $T_B = 0.5\,\text{eV}$

161. An element X belongs to fourth period and fifteenth group of the periodic table. Which one of the following is true regarding the outer electronic configuration of X?

A) It has partially filled *d*-orbitals and completely filled *s*-orbitals

B) It has completely filled *s*-orbitals and completely filled *p*-orbitals

C) It has completely filled *s*-orbitals and half filled *p*-orbitals

D) It has half filled *d*-orbital and completely filled *s*-orbitals

162. Five valence electrons of $_{15}P$ are labelled as

AB	X	Y	Z
3s	3p		

If the spin quantum number of *B* and *Z* is $+\frac{1}{2}$, the group of electrons with three of the quantum number same are

A) *AB, XYZ, BY* B) *AB*

C) *XYZ, AZ* D) *AB, XYZ*

163. The decomposition of a certain mass of $CaCO_3$ gave 11.2 dm^3 of CO_2 gas at STP. The mass of *KOH* required to completely neutralize the gas is

A) 56 *g* B) 28 *g*

C) 42 *g* D) 20 *g*

164. 1 cc of N_2O at NTP contains:

A) $\frac{1\cdot 8}{224}\times 10^{22}$ atoms

B) $\frac{6\cdot 02}{22400}\times 10^{23}$ molecules

C) $\frac{1\cdot 32}{224}\times 10^{23}$ electrons

D) all the above

165. If the ratio of the masses of SO_3 and O_2 gases confined in a vessel is 1 : 1, then the ratio of their partial pressure would be

A) 5 : 2

B) 2 : 5

C) 2 : 1

D) 1 : 2

166. Among the following, which one is a wrong statement

A) I_3^+ has bent geometry

B) PH_3 and $BiCl_5$ do not exist

C) $p\pi - d\pi$ bonds are present in SO_2

D) SeF_4 and CH_4 have same shape

167. Sodium forms Na^+ ion but it does not form Na^{2+} because:

A) very low value of 1st and IInd IE

B) very high value of 1st and IInd IE

C) high value of 1st IE and low value of IInd IE

D) low value of 1st IE and high value of IInd IE

168. In which of the following molecules/ions BF_3, NO_2^-, NH_2^- and H_2O, the central atom is sp^2 hybridized

A) NO_2^- and NH_2^-

B) NH_2^- and H_2O

C) NO_2^- and H_2O

D) BF_3 and NO_2^-

169. The wave number of the spectral line in the emission spectrum of hydrogen will be equal to $\frac{8}{9}$ times the Ryberg's constant if the electron jumps from .....

A) $n=3$ to $n=1$

B) $n=10$ to $n=1$

C) $n=9$ to $n=1$

D) $n=2$ to $n=1$

170. The uncertainties in the velocities of two particles, A and B are 0.05 and 0.02 ms^{-1}, respectively. The mass of *B* is five times to that of the mass of *A*. What is the ratio of uncertainties $\left(\frac{\Delta x_A}{\Delta x_B}\right)$ in their positions

A) 2

B) 0.25

C) 4

D) 1

171. When 4g of an ideal gas A is introduced into an evaculated flask kept at $25^\circ C$, the pressure is found to be one atmosphere. If 6g of another ideal gas B is then added to the same flask, the pressure becomes 2 atm at the same temperature. The ratio of the molecular weights $(M_A : M_B)$ of the two gases would be

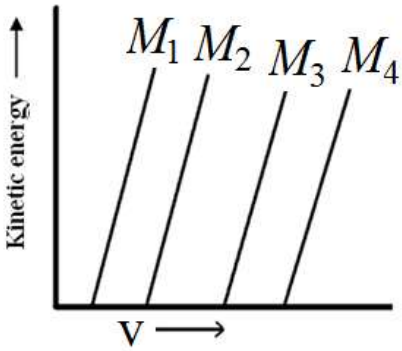
A) 1 : 2

B) 2 : 1

C) 2 : 3

D) 3 : 2

172. A plot of the kinetic energy $\left(\frac{1}{2}mv^2\right)$ of ejected electrons as a function of the frequency (v) of incident radiation of four alkali metals (M_1, M_2, M_3, M_4) is shown below:



The alkali metals M_1, M_2, M_3 and M_4 are respectively

A) Li, Na, K and Rb
B) Rb, K, Na and Li
C) Na, K, Li and Rb
D) Rb, Li, Na and K

173. In Bohr series of lines of hydrogen spectrum, the line from the red end corresponds to which one of the following inter-orbit jumps of the electron for Bohr orbits in an atom of hydrogen?

A) $5 \rightarrow 2$
B) $4 \rightarrow 1$
C) $2 \rightarrow 5$
D) $3 \rightarrow 2$

174. Among KO_2, $KAlO_2$, CaO_2 and NO_2^+, unpaired electron is present in:

A) NO_2^+ and CaO_2
B) KO_2 and $KAlO_2$
C) KO_2 only
D) CaO_2 only

175. Which has the highest bond energy?

A) F_2
B) Cl_2
C) Br_2
D) I_2

176. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements is true for these two species

A) Bond length in NO^+ is equal to that in NO
B) Bond length in NO is greater than in NO^+
C) Bond length in NO^+ is greater than in NO
D) Bond length is unpredictable

177. Consider the following electronic configuration of an element(P):

$$[\text{Xe}]14f^{14}5d^{1}6s^{2}$$

Then correct statement about element 'P' is:

A) It belongs to 6^{th} period and 1^{st} group
B) It belongs to 6^{th} period and 2^{nd} group
C) It belongs to 6^{th} period and 3^{rd} group
D) None of these

178. The total number of protons in 10 g of calcium carbonate is ($N_0 = 6.023 \times 10^{23}$)

A) $1 \cdot 5057 \times 10^{24}$ B) $2 \cdot 0478 \times 10^{24}$

C) $3 \cdot 0115 \times 10^{24}$ D) $4 \cdot 0956 \times 10^{24}$

179. Containers *A* and *B* have same gas. Pressure, volume and temperature of *A* are all twice that of *B*. Then the ratio of the number of molecules of *A* and *B* are

A) 1 : 2 B) 2 : 1

C) 1 : 4 D) 4 : 1

180. Assuming $2s - 2p$ mixing is **NOT** operative, the paramagnetic species among the following is

A) Be_2 B) B_2

C) C_2 D) N_2