# Biology

1.

Read the following four statements (A-D) :
(I) In transcription, adenosine pairs with uracil
(II) Regulation of lac operon by repressor is referred to as positive regulation
(III) The human genome has approximately 50,000 genes
(IV) Haemophilia is a sex-linked recessive disease
How many of the above statements are right ?

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

2.

How many organisms in the list given below are autotrophs ?
Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Sacharomyces, Trypanosoma, Porphyra, Wolfia

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

3.

How many plants in the list given below have marginal placentation ?
Mustard, Gram, Tulip, Asparagus, Arhar, Sun hemp, Chilli, Colchicine, Onion, Moong, Pea, Tobacco, Lupin

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

4.

As compared to a dicot root, a monocot root has :

1. Many xylem bundles
2. Inconspicuous annual rings
3. Relatively thicker periderm
4. More abundant secondary xylem

5.

A test cross is carried out to :
1. Predict whether two traits are linked
2. Assess the number of alleles of a gene
3. Determine whether two species or varieties will breed successfully
4 Determine the genotype of a plant at $F_2$

6.

Which one of the following categories of animals, is correctly described with no single exception in it ?
1 All bony fishes have four pairs of gills and an operculum on each side
2. All sponges are marine and have collared cells
3. All mammals are viviparous and possess diaphragm for breathing
4. All reptiles possess scales, have a three chambered heart and are cold blood (poikilothermal)

7.

The rate of formation of new organic matter by rabbit in a grassland , is called :

1. Secondary productivity
2. Net primary productivity
3. Gross primary productivity

4 Net productivity

8.

In genetic engineering, the antibiotics are used :
1. To select healthy vectors
2. As sequences from where replication starts
3. To keep the cultures free of infection
4. As selectable markers

9.

The secretory phase in the human menstrual cycle is also called :
1. Follicular phase lasting for about 6 days
2. Luteal phase and lasts for about 13 days
3. Follicular phase and lasts for about 13 days
4. Luteal phase and lasts for about 6 days

10.

In gobar gas, the maximum amount is that of :

1. Methane

2. Propane

3. Carbon dioxide

4. Butane

11.

Through their effect on plant growth regulators, what do the temperature and light control in the plants ?

1. Flowering

2. Closure of stomata

3. Fruit elongation

4. Apical dominance

12.

Which one of the following human organs is often called the "graveyard" of RBCs ?

1. Kidney

2. Spleen

3. Liver

4. Gall bladder

13.

Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them ?
1. Garden lizard and Crocodile - Three chambered heart
2. Ascaris and Ancylostoma - Metameric segmentation
3. Sea horse and Flying fish - Cold blooded (poikilothermal)
4. Pteropus and Ornithorhyncus - Viviparity

14.

The idea of mutations was brought forth by :
1. Gregor Mendol, who worked on Pisum sativum
2. Hardy Weinberg, who worked on allele frequencies in a population
3. Charles Darwin, who observed a wide variety of organisms during sea voyage
4. Hugo do Vries, who worked on evening primrose

15.

Select the correct statement about biodiversity :
1. Large scale planting of Bt cotton has no adverse effect on biodiversity
2. Western Ghats have a very high degree of species richness and endemism
3. Conservation of biodiversity is just a fad pursued by the developed countries
4. The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals

16.

Plants with ovaries having only one or a few ovules, are generally pollinated by :

1. Butterflies

2. Birds

3. Wind

4. Bees

17.

Consider the following four statements (I-IV) and select the option which includes all the correct ones only :
(I) Single cell Spirulina can produce large quantities of food rich in protein, minerals, vitamins etc.
(II) Body weight-wise the microorganisms Methylophilus methylotrophus may be able to produce several
times more proteins than the cow per day
(III) Common button mushrooms are a very rich source of vitamin C
(IV) A rice variety has been developed which is very rich in calcium

1. Statements (I) , (III) and (IV)

2. Statements (II) , (III) and (IV)

3. Statements (I) , (II)

4. Statements (III) , (IV)

18.

Which one of the following biomolecules is correctly characterised ?
1. Palmitic acid - an unsaturated fatty acid with 18 carbon atoms
2. Adenylic acid - adenosine with a glucose phosphate molecule
3. Alanine amino acid - Contains an amino group and an acidic group anywhere in the molecule
4. Lecithin - a phosphorylated glyceride found in cell membrane

19.

For its action, nitrogenase requires :
1. Light
2. $Mn^{2+}$
3. Super oxygen radicals
4. High input of energy

20.

Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells) :
1. A particular hormone
2. An antifeedant
3. A toxic protein
4. Both sense and anti-sense RNA

21.

Where do certain symbiotic microorganisms normally occur in human body ?
(1) Oral lining and tongue surface
(2) Vermiform appendix and rectum
(3) Duodenum
(4) Caecum

22.

Identify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres :
1. Metaphase-II
2. Anaphase-I
3. Anaphase-II
4. Metaphase-I

23.

Which one of the following cellular parts is correctly described ?
1. Centrioles - sites for active RNA synthesis

2. Ribosomes - those on chloroplasts are larger (80s) while those in the cytoplasm are smaller (70s)
3. Lysosomes - optimally active at a pH of about 8.5
4. Thylakoids - flattened membranous sacs forming the grana of chloroplasts

24.

Cuscuta is an example of :
1. Brood parasitism
2. Predation
3. Endoparasitism
4. Ectoparasitism

25.

The supportive skeletal structures in the human external ears and in the nose tip are examples of :
1. Areolar tissue
2. Bone
3. Cartilage
4. Ligament

26.

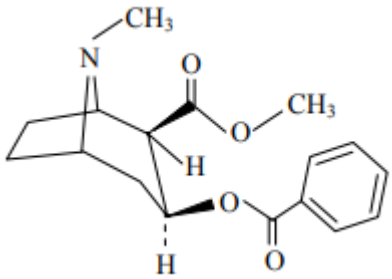
Read the following five statements (I - V) and answer as asked next to them.
(I) In Equisetum the female gametophyte is retained on the parent sporophyte
(II) In Ginkgo male gametophyte is not independent
(III) The sporophyte in Riccia is more developed than that in Polytrichum
(IV) Sexual reproduction in Volvox is isogamous
(V) The spores of slime molds lack cell walls
How many of the above statements are correct ?

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

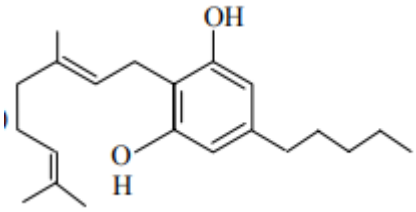
27.

Identify the molecules (a) and (b) shown below and select the right option giving their source and use.

(I)



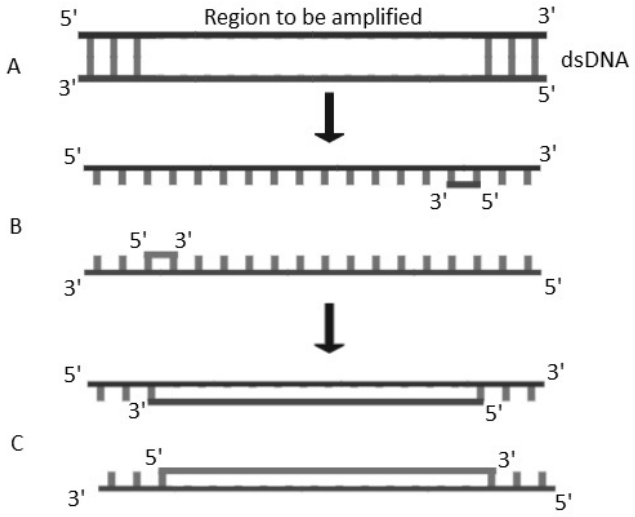

(II)




| | Molecule | Source | Use |
|---|---|---|---|
| 1 | (II) Heroin | Cannabis sativa | Depressent and slows down body functions |
| 2 | (II) Cannabinoid | Atropa belladona | Produces hallucination |
| 3 | (I) Morphine | Papaver somniferum | Sedative and pain killer |
| 4 | (I) Cocaine | Erythroxylum coca | Accelerates the transport of dopamine |

28.

The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?




1. A - Denaturation at a temperature of about 50ºC

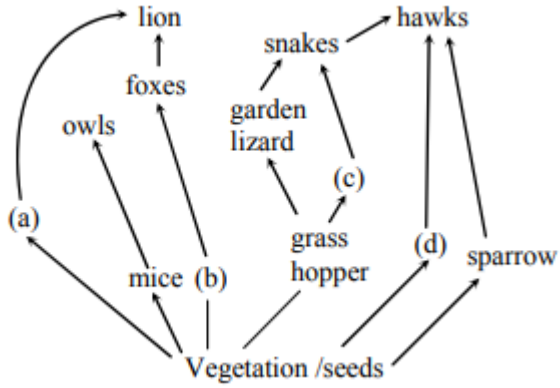
2. C - Extension in the presence of heat stable DNA polymerase

3. A - Annealing with two sets of primers

4. B - Denaturation at a temperature of about 98ºC separating the two DNA strands

29.

Identify the likely organisms (a), (b), (c) and (d) in the food web shown below :




| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| 1 | dog | squirrel | bat | Deer |
| 2 | Rat | Dog | Tortoise | crow |
| 3 | Squirrel | Cat | Rat | Pigeon |
| 4 | Deer | Rabbit | Frog | Rat |

30.

Which one of the following pairs of chemical substances, is correctly categorised ?

1. Pepsin and prolactin - Two digestive enzymes secreted in stomach
2. Troponin and myosin - Complex proteins in striated muscles
3. Secretin and rhodopsin - Polypeptide hormones
4. Calcitonin and thymosin - Thyroid hormones

31.

Vernalisation stimulates flowering in -

(1) Turmeric
(2) Carrot
(3) Ginger
(4) Zamikand

32.

Green revolution in India occurred during -
1. 1970's
2. 1980's
3. 1950's
4. 1960's

33.

A fall in glomerular filtration rate (GFR) activates -
1. Adrenal cortex to release aldosterone
2. Adrenal medulla to release adrenaline
3. Posterior pituitary to release vasopressin
4. Juxta glomerular cells to release renin

34.

What is the function of germ pore ?
1. Absorption of water for seed germination
2. Initiation of pollen tube
3. Release of male gametes
4. Emergence of radicle

35.

Which one of the following option gives the correct categorization of six animals according to the type of nitrogenous wastes (A, B, C,), they give out ?

| | A AMMONOTELIC | B UREOTELIC | C URICOTELIC |
|---|---|---|---|
| 1 | Frog, Lizards | Aquatic Amphibia, Humans | Cockroach, Pigeon |
| 2 | Aquatic Amphibia | Frog, humans | Pigeon, Lizards, Cockroach |
| 3 | Aquatic Amphibia | Cockroach, Humans | Frog, Pigeon, Lizards |
| 4 | Pigeon, Humans | Aquatic Amphibia, Lizards | Cockroach, Frog |

36.

Which one of the following sets of items in the option 1 – 4 are correctly categorized with one exception in it ?

| | ITEMS | CATEGORY | EXCEPTION |
|---|---|---|---|
| 1 | Kangaroo, Koala, wombat | Australian marsupials | Wombat |
| 2 | Plasmodium, Cuscuta, Trypanosoma | Protozoan parasites | Cuscuta |
| 3 | Typhoid, Pneumonia, Diphtheria | Bacterial diseases | Diphtheria |
| 4 | UAA, UAG, UGA | Stop codons | UAG |

37.

Which one of the following generally acts as an antagonist to gibberellins ?
1. Ethylene
2. ABA
3. IAA
4. Zeatin

38.

Which one of the following organisms is scientifically correctly named, correctly printed according to the International Rules of Nomenclature and correctly described ?
1. Plasmodium falciparum – a protozoan pathogen causing the most serious type of malaria
2. Felis tigris – The Indian tiger, well protected in Gir forests.
3. E.Coli – Full name Entamoeba coli, a commonly occurring bacterium in human intestine
4. Musca domestica – The common house lizards, a reptile

39.

Read the following four statements (I-IV) :
(I) Colostrum is recommended for the new born because it is rich in antigen
(II) Chikungunya is caused by a Gram negative bacterium
(III) Tissue culture has proved useful in obtaining virus-free plants
(IV) Beer is manufactured by distillation of fermented grape juice
How many of the above statements are wrong ?

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

40.

Which one of the following organisms is correctly matched with its three characteristics ?
1. Tomato : Twisted aestivation, Axile placentation, Berry
2. Onion : Bulb, Imbricate aestivation, Axile placentation
3. Maize : $C_3$ pathway, Closed vascular bundles, Scutellum
4. Pea : $C_3$ pathway, Endospermic seed, Vaxillary aestivation

41.

The second stage of hydrosere is occupied by plants like
1. Typha
2. Salix
3. Vallisneria
4. Azolla

42.

Which one of the following statements is correct with respect to immunity ?
1. The antibodies against small pox pathogen are produced by T-lymphocytes
2. Antibodies are protein molecules each of which has four light chains
3. Rejection of a kidney graft is the function of B-lymphocytes
4. Preformed antibodies need to be injected to treat the bite by a viper snake

43.

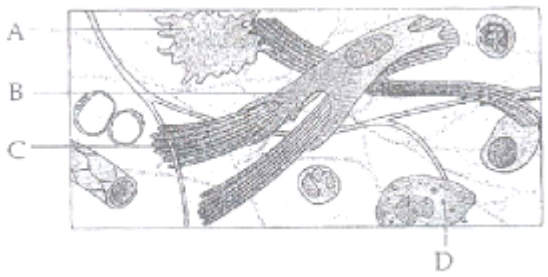
Which one of the following represents a palindromic sequence in DNA ?
1. 5'-CCAATG-3'
   3'-GAATCC-5'
2. 5'-CATTAG-3'
   3'-GATAAC-5'
3. 5'-GATACC-3'
   3'-CCTAAG-5'
4. 5'-GAATTC-3'
   3'-CTTAAG-5'

44.

For its activity, carboxypeptidase requires :
1. Iron
2. Niacin
3. Copper
4. Zinc

45.

Given below is the diagrammatic sketch of a certain type of connective tissue. Identify the parts labeled A, B,C and D and select the right option about them




| | Part-A | Part-B | Part-C | Part-D |
|---|---|---|---|---|
| 1 | Mast cell | Marcophage | Fibroblast | Collagen fibres |
| 2. | Macrophage | Collegen fibres | Fibroblast | Mast cell |
| 3. | Mast cell | Collagen fibres | Fibroblast | Macrophage |
| 4. | Macrophage | Fibroblast | Collagen fibres | Mast cell |

46.

In the five-kingdom classification, Chlamydomonas and Chlorella have been included in
1. Algae
2. Plantae
3. Monera
4. Protista

47.

Read the following four statements (I-IV)
(I) Both, photophosphorylation and oxidative phosphorylation involve uphill transport of protons across the
membrane
(II) In dicot stems, a new cambium originates from cells of pericycle at the time of secondary growth
(III) Stamens in flowers of Gloriosa and Petunia are polyandrous
(IV) Symbiotic nitrogen-fixers occur in free-living state also in soil
How many of the above statements are right

1. Three

2. Four

3. One

4. Two

48.

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

49.

Which one of the following pairs is wrongly matched ?
1. Salvinia - Prothallus
2. Viroids – RNA
3. Mustard-Synergids
4. Ginkgo-Archegonia

50.

What is it that forms the basis of DNA Fingerprinting ?
1. The relative difference in the DNA occurrence in blood, skin and saliva
2. The relative amount of DNA in the ridges and grooves of the fingerprints

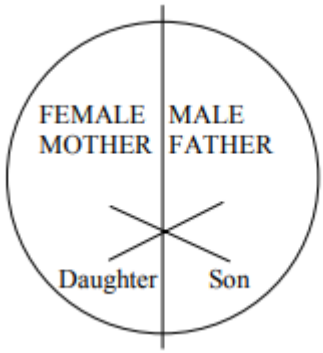
3. Satellite DNA occurring as highly repeated short DNA segments
4. The relative proportions of purines and pyrimidines in DNA

51.

Which one of the following characteristics is common both in humans and adult
frogs ?
1. Internal fertilization
2. Nucleated RBCs
3. Ureotelic mode of excretion
4. Four – chambered heart

52.

Represented below is the inheritance pattern of the certain type of traits in humans. Which one of the following conditions could be an example of this pattern ?




1. Sickel cell anaemia
2. Haemophilia
3. Thalassemia
4. Phenylketonuria

53.

The four sketches (A, B, C and D) given below, represent four different types of animal tissues. Which one of these is correctly identified in the options given, along with its correct location and function ?

(A) 

(B) 

(C) 

(D) 

| | Tissue | Location | Function |
|---|---|---|---|
| 1. | (C) Collagen fibres | Cartilage | Attach skeletal muscles to bones |
| 2. | (D) Smooth muscle tissue | Heart | Heart contraction |
| 3. | (A) Columnar epithelium | Nephron | Secretion and absorption |
| 4. | (B) Glandular epithelium | Intestine | Secretion |

54.

Which one of the following structures is an organelle within an organelle ?
1. Peroxisome
2. ER
3. Mesosome
4. Ribosome

55.

The first clinical gene therapy was given for treating -
1. Chicken pox
2. Rheumatoid arthritis
3. Adenosine deaminase deficiency
4. Diabetes mellitus

56.

Sacred groves are specially useful in -
1. preventing soil erosion
2. year-round flow of water in rivers
3. conserving rare and threatened species
4. generating environmental awareness

57.

Which one of the following is a wrong statement regarding mutations ?
1. Cancer cells commonly show chromosomal aberrations
2. UV and Gamma rays are mutagens
3. Change in a single base pair of DNA does not cause mutation
4. Deletion and insertion of base pairs cause frame-shift mutations

58.

Biolistics (gene-gun) is suitable for -
1. Transformation of plant cells
2. Constructing recombinant DNA by joining with vectors
3. DNA finger printing
4. Disarming pathogen vectors

59.

Which one of the following statements is wrong ?
1. Vegetative cell is larger than generative cell
2. Pollen grains in some plants remain viable for months
3. Intine is made up of cellulose and pectin
4. When pollen is shed at two-called stage, double fertilization does not take place

60.

Identify the human development stage shown below as well as the related right place of its occurrence in a normal pregnant women and select the right option for the two together -

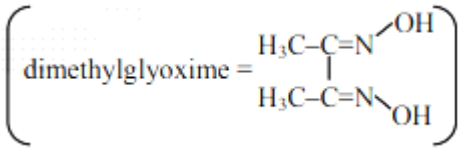
| Developmental stage | Site of occurrence |
|---|---|
| 1. Blastula | End part of Fallopian tube |
| 2. Blastocyst | Uterine wall |
| 3. 8-celled morula | Starting point of Fallopian tube |
| 4. Late morula | Middle part of Fallopian tube |

# Chemistry

61.

Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal Ni(II).
Which of the following statements is not true ?

1. Complex has symmetrical H-bonding.
2. Red complex has a tetrahedral geometry.
3. Dimethylglyoxime functions as bidentate ligand.
4. Red complex has a square planar geometry.




62.

During change of $O_2$ to $O_2^-$ ion, the electron adds on which one of the following orbitals ?

1. $\pi\ orbital$
2. $\sigma^*\ orbital$
3. $\sigma\ orbital$
4. $\pi^*\ orbital$

63.

Consider the reaction :

$$RCHO + NH_2NH_2 \rightarrow RCH = N - NH_2$$

What sort of reaction is it ?
1 Free radical addition – elimination reaction
2. Electrophilic substitution-elimination reaction
3. Nucleophilic addition – elimination reaction
4. Electrophilic addition – elimination reaction

64.

In which of the following arrangements the given sequence is not strictly according to the property indicated against it ?

(1) $H_2O < H_2S < H_2Se < H_2Te$ :
$increa\sin g\ pK_a\ values$

(2) $NH_3 < PH_3 < AsH_3 < SbH_3$ :
$increa\sin g\ \ acidic\ character$

(3) $CO_2 < SiO_2 < SnO_2 < PbO_2$ :
$increa\sin g\ oxidi\sin g\ power$

(4) $HF < HCl < HBr < HI$ :
$increa\sin g\ acidic\ strength$

65.

The Gibb's energy for the decomposition of $Al_2O_3$ at $500^\circ C$ is as follows:

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2; \Delta rG = +960\ kJ\ mol^{-1}$$

The potential difference needed for the electrolytic reduction of aluminium oxide
($Al_2O_3$) at $500^\circ C$ is at least,

1. 3.0 V
2. 2.5 V
3. 5.0 V
4. 4.5 V

66.

Given that the equilibrium constant for the reaction

$2SO_{2(g)} + O_{2(g)} \leftrightharpoons 2SO_{3(g)}$

has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature ?

$SO_{3(g)} \leftrightharpoons SO_{2(g)} + 1/2\, O_{2(g)}$

1. $3.6 \times 10^{-3}$
2. $6.0 \times 10^{-2}$
3. $1.3 \times 10^{-5}$
4. $1.8 \times 10^{-3}$

67.

Which of the following compounds can be used as antifreeze in automobile radiators ?

1. Glycol
2. Nitrophenol
3. Ethyl alcohol
4. Methyl alcohol

68.

Molar conductivities $(\wedge^{\circ}{}_m)$ at infinite dilution of NaCl, HCl and $CH_3COONa$ are 126.4, 425.9 and 91.0 S $cm^2\ mol^{-1}$ respectively. $(\wedge^{\circ}{}_m)$ for $CH_3COOH$ will be:

1. $180.5\ S\ cm^2 mol^{-1}$
2. $290.8\ S\ cm^2 mol^{-1}$
3. $390.5\ S\ cm^2 mol^{-1}$
4. $425.5\ S\ cm^2 mol^{-1}$

69.

Vapour pressure of chloroform $(CHCl_3)$ and dichloromethane $(CH_2Cl_2)$

at $25^{\circ}C$ are 200 mmHg and 41.5 mmHg respectively. Vapour pressure of

the solution obtained by mixing 25.5 g of $(CHCl_3)$ and 40 g of $(CH_2Cl_2)$ at the

same temperature will be:

(Molecular mass of $(CHCl_3)$ = 119.5 u and molecular mass of $(CH_2Cl_2)$ = 85 u)

1. 615.0 mm Hg
2. 347.9 mm Hg
3. 285.5 mm Hg
4. 173.9 mm Hg

70.

A certain gas takes three times as long to effuse out as helium. Its molecular mass will be:

1. 36 u
2. 64 u
3. 9 u
4. 27 u

71.

Which of the following sets forms the biodegradable polymer?

1. $H_2N - CH_2 - COOH$ and

$H_2N - (CH_2)_5 - COOH$

2. $HO - CH_2 - CH_2 - OH$ and

$HOOC - C_6H_4 - COOH$

3. $C_6H_5 - CH = CH_2$ and

$CH_2 = CH - CH = CH_2$

4. $CH_2 = CH - CN$ and

$CH_2 = CH - CH = CH_2$

72.

The catalytic activity of transition metals and their compounds is ascribed mainly to:

1. their unfilled d-orbitals
2. their ability of adopt variable oxidation states
3. their chemical reactivity
4. their magnetic behaviour

73.

Given the reaction between 2 gases represented by $A_2$ and $B_2$ to give the compound $AB_{(g)}$.

$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}$

At equilibrium , the concentrations of $\mathrm{A_2} = 3.0 \times 10^{-3}\,\mathrm{M}$ ; $\mathrm{B_2} = 4.2 \times 10^{-3}\,\mathrm{M}$ and $\mathrm{AB} = 2.8 \times 10^{-3}\,\mathrm{M}$

If the reaction takes place in a sealed vessel at $527^{\circ}C$, then the value of $K_C$ will be :

1. 1.9
2. 0.62
3. 4.5
4. 2.0

74.

Standard reduction potentials of the half reactions are given below :

$F_{2(g)} + 2e^- \rightarrow 2F^-{}_{(aq)}$ ; $E^\circ = +2.85\ V$

$Cl_{2(g)} + 2e^- \rightarrow 2Cl^-{}_{(aq)}$ ; $E^\circ = +1.36\ V$

$Br_{2(g)} + 2e^- \rightarrow 2Br^-{}_{(aq)}$ ; $E^\circ = +1.06\ V$

$I_{2(g)} + e^- \rightarrow 2I^-{}_{(aq)}$ ; $E^\circ = +0.53\ V$

The strongest oxidizing and reducing agents respectively are -

1. $Br_2\ and\ Cl^-$
2. $Cl_2\ and\ Br^-$
3. $Cl_2\ and\ I_2$
4. $F_2\ and\ l^-$

75.

Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them -

1. $O_2^- < NO < C_2^{2-} < He_2^+$
2. $C_2^{2-} < He_2^+ < O_2^- < NO$
3. $He_2^+ < O_2^- < NO < C_2^{2-}$
4. $NO < O_2^- < C_2^{2-} < He_2^+$

76.

Low spin complex of $d^6$-cation in an octahedral field will have the following energy :

1. $\frac{-12}{5}\ \Delta_0 + 3P$
2. $\frac{-2}{5}\ \Delta_0 + 2P$
3. $\frac{-2}{5}\ \Delta_0 + P$
4. $\frac{-12}{5}\ \Delta_0 + P$

($\Delta_0$ = Crystal field splitting energy in an octahedral field, P = Electron pairing energy)

77.

Which of the following compounds will give a yellow precipitate with iodine and alkali ?

1. Methyl acetate
2. Acetamide
3. 2-Hydroxypropane
4. Acetophenone

78.

The orbital angular momentum of a p-electron is given as -

1. $\sqrt{3}\ \frac{h}{2\pi}$
2. $\sqrt{\frac{3}{2}}\frac{h}{\pi}$
3. $\sqrt{6}\ \sqrt{\frac{h}{2\pi}}$
4. $\frac{h}{\sqrt{2}\pi}$

79.

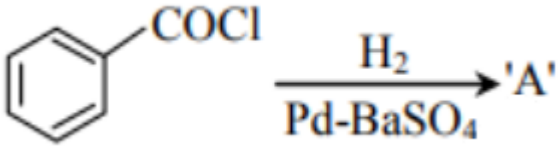
Which one of the following does not correctly represent the correct order of the property indicated against it ?
1. $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$: increasing magnetic moment
2. $Ti < V < Cr < Mn$ : increasing melting point
3. Ti < V < Mn < Cr : increasing 2nd ionization enthalpy
4. Ti < V < Cr < Mn : increasing number of oxidation states

80.

Chloroamphenicol is an :
1. antihistaminic
2. antiseptic and disinfectant
3. antibiotic-broad spectrum
4. antifertility drug

81.

Consider the following reaction :




The product 'A' is -

1. $C_6H_5OH$
2. $C_6H_5COCH_3$
3. $C_6H_5Cl$
4. $C_6H_5CHO$

82.

Which of the following reagents will be able to distinguish between 1-butyne and 2-butyne ?
1. HCl
2. $O_2$
3. $Br_2$
4. $NaNH_2$

83.

For real gases van der Waals equation is written as

$$\left(P+\frac{an^2}{V^2}\right)\left(V-nb\right)\ =\ nRT$$

Where 'a' and 'b' are van der Waals constants.

Two sets of gases are :
(I) $O_2,\ CO_2\ ,\ H_2\ and\ He$ (II)$CH_4,\ O_2\ and\ H_2$
The gases given in set-I in increasing order of 'b' and gases given in set-II in decreasing order of 'a', are arranged below. Select the correct order from the following :

1. $(\ I)O_2 < He < H_2 < CO_2(II)\ H_2 > O_2 > CH_4$
2. $(\ I)H_2 < He < O_2 < CO_2(II)\ CH_4 > O_2 > H_2$
3. $(\ I)H_2 < O_2 < He < CO_2(II)\ O_2 > CH_4 > H_2$
4. $(\ I)He < H_2 < CO_2 < \ O_2(II)\ CH_4 > H_2 > O_2$

84.

Activation energy $E_a$ and rate constant ($k_1$ and $k_2$) of a chemical reaction at two different temperatures ($T_1$ and $T_2$) are related by -

1. $ln\ \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)$
2. $In\ \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2}+\frac{1}{T_1}\right)$
3. $In\ \frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)$
4. $In\ \frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$

85.

Which of the following exhibits only + 3 oxidation state ?
1. Th
2. Ac
3. Pa
4. U

86.

Equal volumes of two monoatomic gases, A and B, at same temperature and pressure are mixed. The ratio of specific heats (Cp/Cv) of the mixture will be -

1. 1.50
2. 3.3
3. 1.67
4. 0.83

87.

Structure of a mixed oxide is cubic close-packed (CCP). The cubic unit cell of mixed oxide is composed of oxide ions. One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B. The formula of the oxide is -

1. $A_2BO_2$
2. $A_2B_3O_4$
3. $AB_2O_2$
4 $ABO_2$

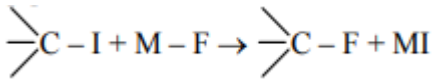
88.

Four successive members of the first series of the transition metals are listed below.For which one of the them the standard potential $\left(E^{\circ}{}_{M^{2+}/M}\right)$ value has a positive sign ?

1. Ni (Z = 28)
2. Cu (Z = 29)
3. Fe (Z = 26)
4. Co (Z = 27)

89.

In replacement reaction

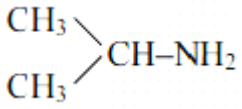


The reaction will be most favorable if M happens to be -

1. K
2. Rb
3. Li
4. Na

90.

An organic compound ($C_3H_9N$) (A), when treated with nitrous acid, gave an alcohol and $N_2$ gas was evolved. (A) on warming with $CHCl_3$ and caustic potash gave (C) which on reduction gave isopropylmethylamine. Predict the structure of (A)

1. $CH_3CH_2-NH-CH_3$
2. $CH_3-\underset{\underset{CH_3}{|}}{N}-CH_3$
3. $CH_3CH_2CH_2-NH_2$
4. 

# Physics

91.

The instantaneous values of alternating current and voltages in a circuit are given as

$i = \frac{1}{\sqrt{2}}\sin\left(100\,\pi t\right)\ ampere$

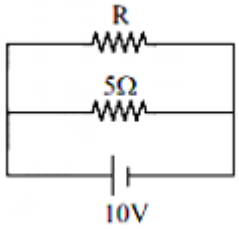
$e = \frac{1}{\sqrt{2}}\sin\left(100\pi t\ +\ \pi/3\right)\ volt$

The average power in Watts consumed in the circuit is :

1. $\frac{\sqrt{3}}{4}$
2. $\frac{1}{2}$
3. $\frac{1}{8}$
4. $\frac{1}{4}$

92.

The power dissipated in the circuit shown in the figure is 30 Watts. The value of R is:




1. 15 $\Omega$
2. 10 $\Omega$
3. 30 $\Omega$
4. 20 $\Omega$

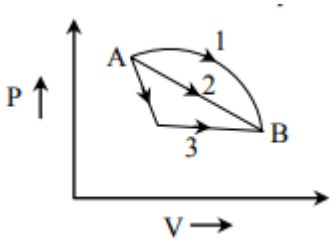
93.

The dimensions of $(\mu_0\varepsilon_0)^{-1/2}$ are -

1. $[\,L^{-1}T\,]$
2. $[\,LT^{-1}\,]$
3. $[\,L^{1/2}T^{1/2}\,]$
4. $[\,L^{1/2}T^{-1/2}\,]$

94.

An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram -

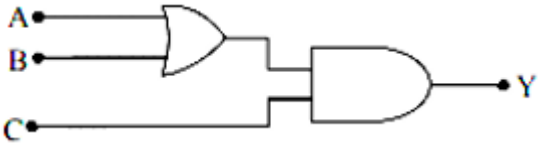



If $Q_1$, $Q_2$ , $Q_3$ indicate thye heat absorbed by the gas along the three processes and $\Delta U_1$ , $\Delta\, U_2$ , $\Delta\, U_3$ indicate the change in internal energy along the three processes repectively, then -

1. $Q_3 > Q_2 > Q_1\ and\ \Delta\, U_1 = \Delta U_2 = \Delta\, U_3$
2. $Q_1 = Q_2 = Q_3\ and\ \Delta\, U_1 > \Delta U_2 > \Delta\, U_3$
3. $Q_3 > Q_2 > Q_1\ and\ \Delta\, U_1 > \Delta U_2 > \Delta\, U_3$
4. $Q_1 > Q_2 > Q_3\ and\ \Delta\, U_1 = \Delta U_2 = \Delta\, U_3$

95.

To get output Y = 1 in given circuit which of the following input will be correct -




| | A | B | C |
|---|---|---|---|
| 1. | 1 | 0 | 1 |
| 2 | 1 | 1 | 0 |
| 3. | 0 | 1 | 0 |
| 4. | 1 | 0 | 0 |

96.

Two metallic spheres of radii 1 cm and 3cm are given charges of $-1 \times 10^{-2}\ C\ and\ 5 \times 10^{-2}\ C$, respectively. If these are connected by a conducting wire , the final charge on the sphere is-

1. $3 \times 10^{-2}\ C$
2. $4 \times 10^{-2}\ C$
3. $1 \times 10^{-2}\ C$
4. $2 \times 10^{-2}\ C$

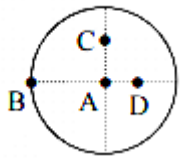
97.

Two radiations of photons energies 1 eV and 2.5 eV , successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximum speeds of the emitted electrons is -

1. 1 : 2
2. 1 : 1
3. 1 : 5
4. 1 : 4

98.

The moment of inertia of a uniform circular disc is maximum about an axis perpendicular to the disc and passing through -




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

99.

A train is moving at a speed of $220\ ms^{-1}$ towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected back to the train as echo. The frequency of the echo as detected by the driver of the train is -(speed of sound in air is $330\ ms^{-1}$)

1. 4000 Hz
2. 5000 Hz
3. 3000 Hz
4. 3500 Hz

100.

The half of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time $t_2$ when $\frac{2}{3}$ of it has decayed and the time $t_1$ when $\frac{1}{3}$ of it had decayed is -

1. 50 days
2. 60 days
3. 15 days
4. 30 days

101.

A car of mass m is moving on a level circular track of radius R. If $\mu_s$ represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by -

1. $\sqrt{Rg/\mu_s}$
2. $\sqrt{mRg/\mu_s}$
3. $\sqrt{\mu_s Rg}$
4. $\sqrt{\mu_s mRg}$

102.

A circular platform is mounted on a frictionless vertical axle. Its radius R = 2m and its moment of intertia about the axle is 200 $kg\,m^2$. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of $1\,ms^{-1}$ relative to the ground. Time taken by the man to complete one revolution is -

1. $\frac{3\pi}{2}s$
2. $2\pi\ s$
3. $\frac{\pi}{2}s$
4. $\pi\ s$

103.

If the momentum of an electron is changed by P, then the de-Broglie wavelength associated with it changes by 0.5 %. The initial momentum of electron will be-

1. 400 P
2. $\frac{P}{200}$
3. 100 P
4. 200 P

104.

If $v_e$ is escape velocity and $v_o$ is orbital velocity of a satellite for orbit close to the earth's surface, thyen these are related by -

1. $v_o = v_e$
2. $v_e\ =\ \sqrt{2v_o}$
3. $v_e\ =\ \sqrt{2}\,v_o$
4. $v_o\ =\ \sqrt{2}\,v_e$

105.

The equation of a simple harmonic wave is given by $y\ =\ 3\ \sin\ \frac{\pi}{2}\left(50t - x\right)$ where x and y are in meters and t is in seconds. The ratio of maximum particle velocity to the wave velocity is -

1. $\frac{3}{2}\pi$
2. $3\pi$
3. $\frac{2}{3}\pi$
4. $2\pi$

106.

A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an $\alpha-$particle to describe a circle of the same radius in the same field?

1. 1 MeV
2. 0.5 MeV
3. 4 MeV
4. 2MeV

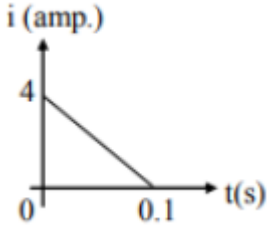
107.

Three masses are placed on the x-axis : 300 g at origin, 500 g at x = 40 cm and 400 g at x = 70 cm. The distance of the centre of mass from the origin is -

1. 45 cm
2. 50 cm
3. 30 cm
4. 40 cm

108.

In a coil of resistance 10 $\Omega$, the induced current develpoed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is -




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

109.

A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is-

1. $E^2Ad/\varepsilon_0$
2. $\frac{1}{2}\varepsilon_0E^2Ad$
3. $\varepsilon_0EAd$
4. $\frac{1}{2}\varepsilon_0E^2$

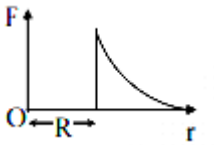
110.

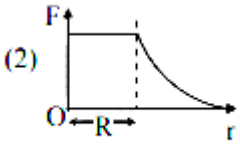
A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude $P_0$. The instantaneous velocity of this car is proportional to -

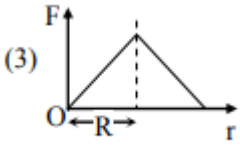
1. $t^{1/2}$
2. $t^{-1/2}$
3. $t/\sqrt{m}$
4. $t^2P_0$

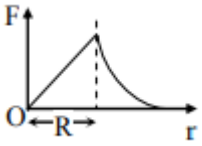
111.

Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R ? (r is measured from the centre of the spherical shell).

1. 


2. 


3. 


4. 


112.

The input resistance of a silicon transistor is 100 Ω. Base current is changed by 40 μA which results in a change in collector current by 2 mA. This transistor is used as a common emitter amplifier with a load resistance of 4 KΩ. The voltage gain of the amplifier is-

1. 3000
2. 4000
3. 1000
4. 2000

113.

For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index -

1. lies between 2 and $\sqrt{2}$
2. is less than 1
3. is greater than 2
4. lies between $\sqrt{2}$ and 1

114.

The transition from the state n = 3 to n = 1 in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from -

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

115.

A rod of length 10 cm lies along the principal axis of concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is -

1. 15 cm
2. 2.5 cm
3. 5 cm
4. 10 cm

116.

A slab of stone of area $0.36\ m^2$ and thickness 0.1 is exposed on the lower surface to steam at $100^{\circ}C$. A block of ice at $0^{\circ}C$ rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is- (Given latent heat of fusion of ice = $3.36 \times 10^5\ J\ Kg^{-1}$)

1. $1.29\ J/m/s/_{\circ}C$
2. $2.05\ J/m/s/_{\circ}C$
3. $1.02\ J/m/s/_{\circ}C$
4. $1.24\ J/m/s/_{\circ}C$

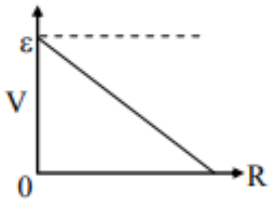
117.

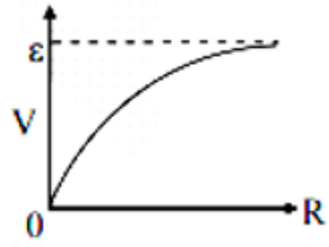
A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100 % more than the previous height, the momentum when it hits the ground will change by -

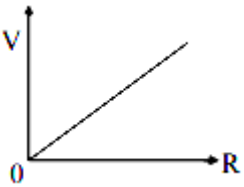
1. 41 %
2. 200%
3. 100%
4. 68%

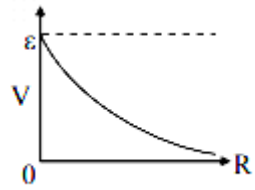
118.

A cell having an emf ε and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by -

1. 


2. 


3. 


4. 


119.

A magnetic needle suspended parallel to a magnetic field requires $\sqrt{3}$ J of work to turn it through $60^\circ$. The torque needed to maintain the needle in this position will be-

1. 3 J
2. $\sqrt{3}\ J$
3. $\frac{3}{2}J$
4. $2\sqrt{3}\ J$

120.

The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to -

1. reciprocal of speed of light in vacuum
2. the ratio of magnetic permeability to the electric susceptiblity of vaccum
3. unity
4. the speed of light in vacuum