The Most Innovative Institute

Resonance®

Educating for better tomorrow

KCET - 2016

May, 2016

KARNATAKA COMMON ENTRANCE TEST

MAY, 2016

QUESTION WITH SOLUTIONS OF CHEMISTRY, PHYSICS, MATHEMATICS AND BIOLOGY

Name of the Candiate (in Capital letters) : ______________________________

Roll Number : in figures : | | | | | | | | | in words : ______________________________

Name of Examination Centre (in Capital letters) : ______________________________

Candidate's Signature : ____________________ Invigilator's Signature : ____________________

KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
CHEMISTRY
Test Paper Code: D – 3
KEYS

Q. No.	Keys	Q. No.	Keys	Q. No.	Keys
1.	(1)	21.	(2)	41.	(3)
2.	(2)	22.	(1)	42.	(1)
3.	(3)	23.	(2)	43.	(3)
4.	(3)	24.	(1)	44.	(1)
5.	(3)	25.	(1)	45.	(2)
6.	(1)	26.	(4)	46.	(3)
7.	(3)	27.	(3)	47.	(3)
8.	(3)	28.	(2)	48.	(1)
9.	(3)	29.	(2)	49.	(2)
10.	(1)	30.	(3)	50.	(1)
11.	(2)	31.	(3)	51.	(1)
12.	(4)	32.	(3)	52.	(4)
13.	(2)	33.	(2)	53.	(3)
14.	(4)	34.	(1)	54.	(3)
15.	(4)	35.	(2)	55.	(2)
16.	(3)	36.	(3)	56.	(3)
17.	(3)	37.	(3)	57.	(3)
18.	(2)	38.	(1)	58.	(1)
19.	(2)	39.	(3)	59.	(4)
20.	(3)	40.	(1)	60.	(2)

KARNATAKA COMMON ENTRANCE TEST – MAY, 2016
CHEMISTRY - SOLUTIONS
Test Paper Code : D-3

1. A miscible mixture of $C_6H_6 + CHCl_3$ can be separated by

   (1) Distillation (2) Crystallisation (3) Sublimation (4) Filtration

   Ans (1)

   Distillation

2. The property which is not true about Fluorine is,

   (1) It forms only one oxo acid

   (2) High F-F bond dissociation enthalpy

   (3) Most of its reactions are exothermic

   (4) Highest electronegativity

   Ans (2)

   F_2 has low bond dissociation enthalpy due to small size and repulsion due lone pair electrons.

3. The energy of electron in the n^{th} Bohr orbit of H-atom is

   (1) $\frac{-13.6}{n}$eV (2) $-\frac{13.6}{n^3}$eV (3) $\frac{-13.6}{n^2}$eV (4) $\frac{-13.6}{n^4}$eV

   Ans (3)

   $E_n = \frac{-13.6}{n^2}$eV

4. Which of the following is a polyamide?

   (1) Terylene (2) Buna-S (3) Nylon-6, 6 (4) Polythene

   Ans (3)

   Nylon-6, 6

5. The correct statement regarding entropy is,

   (1) At absolute zero temperature, the entropy of a perfectly crystalline substance is +ve

   (2) At 0 °C, the entropy of a perfect crystalline solid is zero

   (3) At absolute zero temperature, entropy of a perfectly crystalline solid is zero

   (4) At absolute zero temperature, the entropy of all crystalline substances is zero

   Ans (3)

   3rd law of thermodynamics

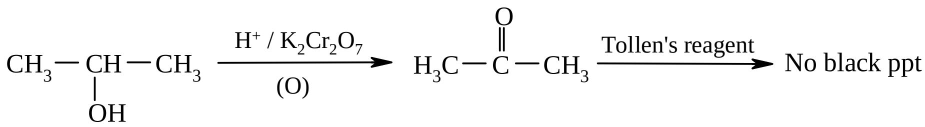
6. The contribution of particle at the edge centre to a particular unit cell is,

   (1) $\frac{1}{4}$ (2) $\frac{1}{8}$ (3) $\frac{1}{2}$ (4) 1

   Ans (1)

   Particle at edge centre is shared by four unit cells.

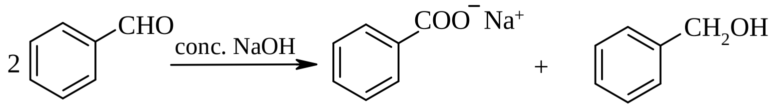
7. An organic compound X is oxidised by using acidified $K_2Cr_2O_7$ solution. The product obtained reacts with phenyl hydrazine but does not answer silver mirror test. The compound X is,
(1) Ethanal (2) $CH_3CH_2CH_3$ (3) 2-propanol (4) Ethanol
Ans (3)



8. The composition of 'copper matte' is,
(1) $Cu_2S + Cu_2O$ (2) $Cu_2O + FeS$ (3) $Cu_2S + FeS$ (4) $Cu_2S + FeO$
Ans (3)
$Cu_2S + FeS$

9. Osmotic pressure of the solution can be increased by,
(1) decreasing the temperature of the solution (2) diluting the solution
(3) increasing the temperature of the solution (4) increasing the volume of the vessel
Ans (3)
van't Hoff-Charle's law

10. Benzene carbaldehyde is reacted with concentrated NaOH solution to give the products A and B. The product A can be used food preservative and the product B is an aromatic hydroxy compound where OH group is linked to sp^3 hybridised carbon atom next to Benzene ring. The products A and B are respectively,
(1) Sodium benzoate and phenyl methanol (2) Sodium benzoate and picric acid
(3) Sodium benzoate and phenol (4) Sodium benzoate and cresol
Ans (1)
Cannizzaro reaction



Sodium benzoate
(food preservative)

Phenyl methanol

11. Replacement of Cl of Chlorobenzene to give phenol requires drastic conditions, but Cl of 2,4-dinitro chlorobenzene is readily replaced. This is because,
(1) – NO_2 group withdraws electrons from meta position
(2) – NO_2 withdraws electrons from ortho and para positions
(3) – NO_2 group makes the ring electron rich at ortho and para positions
(4) – NO_2 donate electrons at meta position
Ans (2)
– NO_2 group is highly electron withdrawing by resonance.

12. Sulphur sol contains
(1) Discrete S-molecules (2) Water dispersed in Solid Sulphur
(3) Discrete S-atoms (4) Large aggregates of S-molecules
Ans (4)
Large aggregates of S-molecules

13. The number of isomers possible for the octahedral complex $[CoCl_2(en)(NH_3)_2]^+$ is,

(1) Three (2) Four isomers (3) Two (4) No isomer

Ans (2)

Four isomers possible

14. The amount of current in Faraday is required for the reduction of 1 mol of Cr_2O_7 ions to Cr^{3+} is,

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

Ans (4)

$$\overset{(+6)}{Cr_2}O_7^{2-} \longrightarrow 2Cr^{3+}$$

Change in O.N = 6 units

$\therefore$ 6 Faraday is required

15. A secondary cell is one

(1) can be recharged by passing current through it in the same direction

(2) can not recharged

(3) can be recharged

(4) can be recharged by passing current through it in the opposite direction

Ans (4)

Can be recharged by passing current through it in the opposite direction

16. The half-life period of a 1^{st} order reaction is 60 minutes. What percentage will be left over after 240 minutes?

(1) 4.25% (2) 6% (3) 6.25% (4) 5%

Ans (3)

For a 1^{st} order reaction

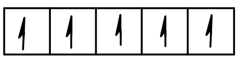
$$1005 \xrightarrow{\text{60 min}} 50\% \xrightarrow{\text{60 min}} 25\% \xrightarrow{\text{60 min}} 12.5\% \xrightarrow{\text{60 min}} 6.25\%$$

17. The bivalent metal ion having maximum paramagnetic behaviour among the first transition series elements is,

(1) Cu^{2+} (2) Cu^+ (3) Mn^{2+} (4) Sc^{2+}

Ans (3)

Mn^{2+} : [Ar] $3d^5$ $4s^0$



3d

18. Equilibrium constants K_1 and K_2 for the following equilibria

(a) $NO_{(g)} + \frac{1}{2}O_{2(g)} \rightleftharpoons NO_{2(g)}$

(b) $2NO_{2(g)} \rightleftharpoons 2NO_{(g)} + O_{2(g)}$

are related as :

(1) $K_2 = \frac{1}{K_1}$ (2) $K_2 = \frac{1}{K_1^2}$

(3) $K_1 = \sqrt{K_2}$ (4) $K_1 = 2K_2$

Ans (2)

$$K_1 = \frac{[NO_2]}{[NO][O_2]^{\frac{1}{2}}}$$

$$K_2 = \frac{1}{\frac{[NO]^2[O_2]}{[NO_2]^2}} = \frac{1}{K_1^2}$$

19. Which is true regarding nitrogen?

(1) Has low ionisation enthalpy

(2) Ability to form $p\pi$-$p\pi$ bonds with itself

(3) Less electronegative

(4) d-orbitals are available

Ans (2)

N has the ability to form $p\pi$-$p\pi$ bonds with itself due to small size and high electronegativity.

20. The complex formed when Al_2O_3 is leached form Bauxite using concentrated NaOH solution is,

(1) $NaAl_2O_4$ (2) Na_2AlO_2 (3) $Na[Al(OH)_4]$ (4) $Na_2[Al(OH)_3]$

Ans (3)

$$Al_2O_3 + 2NaOH + 3H_2O \longrightarrow 2Na[Al(OH)_4]$$

21. Reactions in Zeolite catalyst depend on,

(1) Apertures (2) All of these (3) Pores (4) Size of cavity

Ans (2)

22. For a chemical reaction,

$mA \rightarrow xB$, the rate law is $r = k[A]^2$.

If the concentration of A is doubled, the reaction rate will be

(1) Quadrupled (2) Unchanged (3) Doubled (4) Increases by 8 times

Ans (1)

$r = k[A]^2$

$r = k2^2$

$\therefore$ $r = 4k$

23. Consider the following sets of quantum numbers :

Which of the below setting is not permissible arrangement of electrons in an atom?

	n	***l***	**m**	**s**
(1)	5	3	0	$+\frac{1}{2}$
(2)	3	2	–3	$+\frac{1}{2}$
(3)	4	0	0	$-\frac{1}{2}$
(4)	3	2	– 2	$-\frac{1}{2}$

Ans (2)

n	*l*	m	s
3	2	−3	+1/2

m can have values = – 2, –1, 0, +1, +2

24. Schottky defect in a crystal is observed when,

(1) Equal number of cations and anions are missing from the lattice

(2) No ion is missing from its lattice site

(3) Unequal number of cations and anions are missing from the lattice

(4) An ion leaves its normal site and occupies an interstitial site

Ans (1)

Equal number of cations and anions are missing from the lattice.

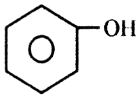
25. CO is a stronger ligand than Cl^-, because

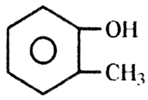
(1) CO has π-bonds
(2) CO is more reactive
(3) CO is a neutral molecule
(4) CO is poisonous

Ans (1)

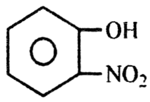
CO has π-bonds

26. Which of the following compound is most acidic?

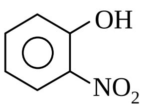
(1) 

(2) 

(3) $Cl - CH_2 - CH_2 - OH$

(4) 

Ans (4)



Electron withdrawing nitro group increases acidity of phenols.

27. The number of oxygen atoms in 4.4 gm of CO_2 is,

(1) 6×10^{22}
(2) 12×10^{23}
(3) 1.2×10^{23}
(4) 6×10^{23}

Ans (1)

44 g of CO_2 contains 6.022×10^{23} CO_2 molecules

$\therefore$ 4.4 g of CO_2 contains 6.022×10^{22} CO_2 molecules

Each CO_2 molecule contains two oxygen atoms

$\therefore$ 6.022×10^{22} CO_2 molecules contain 1.2×10^{23} O atoms

28. HCl gas is covalent and NaCl is an ionic compound. This is because

(1) Hydrogen is a non-metal

(2) Electronegativity difference between H and Cl is less than 2.1

(3) Sodium is highly electro positive

(4) HCl is a gas

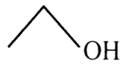
Ans (2)

Electronegativity difference between H and Cl is less than 2.1

29. In the reaction :

$$\text{Ethanol} \xrightarrow{PCl_5} X \xrightarrow{\text{alc KOH}} Y \xrightarrow[H_2O,\ \Delta]{H_2SO_4,\ \text{Room temp.}} Z, \text{ the product Z is,}$$

(1) $CH_3CH_2OCH_2CH_3$

(2) 

(3) C_2H_4

(4) $CH_3CH_2OSO_3H$

Ans (2)

$$C_2H_5OH \xrightarrow{PCl_5} C_2H_5Cl \xrightarrow{\text{alc. KOH}} C_2H_4 \xrightarrow{H_2SO_4,\ \text{room temperature}} H_3C-CH_2OSO_3H \xrightarrow{H_2O,\ \Delta} C_2H_5OH$$

30. As per IUPAC norms, the name of the complex $[Co(en)_2(ONO)Cl]Cl$ is

(1) Chloro bis(ethylene diamine) nitro-o-cobalt (III) chloride

(2) Chloro ethylene diamine nitro-o-cobalt (III) chloride

(3) Chlorido bis(ethane-1, 2-diamine) nitro-o-cobalt (III) chloride

(4) Chlorido di(ethylene diamine) nitro cobalt (III) chloride

Ans (3)

Chlorido bis(ethane-1,2-diamine) nitro-o-cobalt (III) chloride

31. Which of the following is correct about H-bonding in DNA?

(1) A – G, T – C

(2) A – A, T – T

(3) A – T, G – C

(4) G – T, A – C

Ans (3)

$\underset{\text{2H-bonds}}{\underset{\downarrow}{A-T}}$, $\underset{\text{3H-bonds}}{\underset{\downarrow}{G-C}}$

32. Which of the following sequence is correct regarding field strength of ligands as per spectrochemical series?

(1) $F^- < SCN^- < CN^- < CO$

(2) $SCN^- < CO < F^- < CN^-$

(3) $SCN^- < F^- < CN^- < CO$

(4) $CN^- < F^- < CO < SCN^-$

Ans (3)

$SCN^- < F^- < CN^- < CO$

33. Which of the following is incorrect in a galvanic cell?

(1) Reduction occurs at cathode

(2) The electrode at which electrons are lost is called cathode

(3) Oxidation occurs at anode

(4) The electrode at which electrons are gained is called cathode

Ans (2)

Electrons are gained at cathode.

34. Which of the following gives positive Fehling's solution test?

(1) Glucose (2) Protein (3) Sucrose (4) Fats

Ans (1)

Glucose

Being a reducing sugar it answers Fehling's test.

35. Which of the following statements is incorrect w.r.t. Physisorption?

(1) More easily liquifiable gases are adsorbed easily

(2) $\Delta H_{adorption}$ is low and +ve

(3) The forces involved are van der Waal's forces

(4) Under high pressure it results into Multi-molecular layer on adsorbent surface

Ans (2)

ΔH adsoprtion is low but not +ve. Physisorption is an exothermic process.

36. Which of the following is employed as Tranquilizer?

(1) Naproxen (2) Dettol (3) Equanil (4) Tetracyclin

Ans (3)

Equanil

37. The reaction which involves dichlorocarbene as an electrophile is,

(1) Kolbe's reaction (2) Fittig's reaction

(3) Reimer-Tiemann reaction (4) Friedel-Craft's acylation

Ans (3)

Riemer-Tiemann reaction involves dichlorocarbene intermediate.

38. In the following sequence of reactions;

$A \xrightarrow{\text{Reduction}} B \xrightarrow{HNO_2} CH_3CH_2OH$

The compound A is

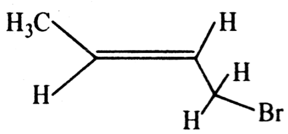
(1) Ethane nitrile (2) CH_3NC (3) Propane nitrile (4) CH_3NO_2

Ans (1)

$$\underset{\text{A}}{CH_3C\equiv N} \xrightarrow{\text{Reduction}} CH_3CH_2NH_2 \xrightarrow{HNO_2} \underset{\text{B}}{CH_3CH_2OH}$$

Ethane nitrile Ethylamine

39. IUPAC name of the compound



is,

(1) 2-Bromo-2-butene (2) 1-Bromo but-3-ene

(3) 1-Bromo but-2-ene (4) Bromo butene

Ans (3)

1-Bromo but-2-ene

40. Electrophile that participates in nitration of benzene is

(1) NO_2^+ (2) NO_3^- (3) NO^+ (4) NO

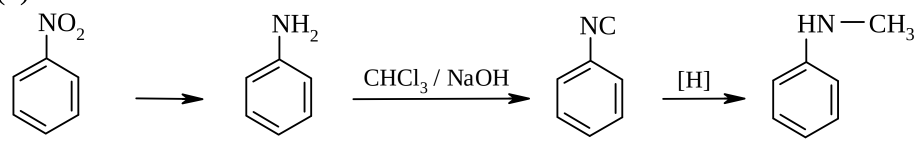
Ans (1)

NO_2^+, nitronium ion

41. An organic compound A on reduction gives compound B, which on reaction with trichloro methane and caustic potash forms C. The compound 'C' on catalytic reduction gives N–methyl benzenamine, the compound 'A' is,

(1) Nitromethane (2) Benzenamine (3) Nitrobenzene (4) Methanamine

Ans (3)



Nitrobenzene (A) Aniline (B) (C) N-methyl benzenamine

42. Which of the following is not a colligative property?

(1) Optical activity (2) Elevation in Boiling point

(3) Osmotic pressure (4) Depression in Freezing point

Ans (1)

Optical activity is not a colligative property.

43. When a brown compound of Mn (A) is treated with HCI, it gives a gas (B). The gas (B) taken in excess reacts with NH_3 to give an explosive compound (C).

The compounds A, B and C are

(1) A = MnO, B = Cl_2, C = NH_4Cl (2) A = MnO_3, B = Cl_2, C = NCl_2,

(3) A = MnO_2, B = Cl_2, C=NCl_3 (4) A = Mn_3O_4, B = Cl_2, C = NCl_3

Ans (3)

$$\underset{A}{MnO_2} \xrightarrow{HCl} \underset{B}{Cl_2} + MnCl_2 + 2H_2O$$

$$\underset{B}{Cl_2} \xrightarrow{NH_3} \underset{C}{NCl_3}$$

44. Reactivity of order of halides for dehydrohalogenation is

(1) R – I > R – Br > R – C*l* > R – F (2) R – F > R – I > R – Br > R – CI

(3) R – F > R – C*l* > R – Br > R – I (4) R – I > R – C*l* > R – Br > R – F

Ans (1)

R – I > R – Br > R – Cl > R –F

45. Main axis of diatomic molecule is Z. The orbitals P_x and P_y overlap to form

(1) σ - molecular orbital (2) No bond is formed.

(3) π - molecular orbital (4) δ - molecular orbital

Ans (2)

No bond is formed as no overlap is possible between P_x and P_y.

46. Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation to their +3 state, because

(1) Mn^{2+} is bigger in size.

(2) Mn^{2+} does not exist.

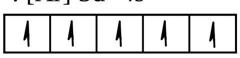
(3) Mn^{2+} is more stable with high 3rd ionisation energy.

(4) Mn^{2+} has completely filled d-orbitals.

Ans (3)

Mn^{2+} has half filled stable configuration and hence 3rd ionisation energy is higher.

Mn^{2+} : [Ar] $3d^5\ 4s^o$



47. Ethanol is converted into ethoxy ethane,

(1) by heating Ethanol with excess of conc. H_2SO_4 at 443 K.

(2) by treating with conc. H_2SO_4 at 273 K.

(3) by heating excess of ethanol with conc. H_2SO_4 at 140 °C.

(4) by treating with conc. H_2SO_4 at room temperature.

Ans (3)

$$2CH_3CH_2OH \xrightarrow[140\ ^\circ C]{conc.\ H_2SO_4} CH_3CH_2OCH_2CH_3 + H_2O$$

48. Which of the following is not true?

(1) Natural rubber has 'trans' configuration at every double bond.

(2) Natural rubber is 1, 4-polymer of isoprene.

(3) In vulcanisation the rubber becomes harder and stronger.

(4) Buna-S is a co-polymer of Butene and styrene.

Ans (1) & (4)

Natural rubber is cis-polyisoprene

Buna-S is a co-polymer of Butadiene and styrene.

49. The increasing order of bond order of O_2, O_2^+, O_2^- and O_2^{--} is

(1) $O_2^{--}, O_2^-, O_2^+, O_2$ (2) $O_2^{2-}, O_2^-, O_2, O_2^+$

(3) $O_2^+, O_2, O_2^-, O_2^{--}$ (4) $O_2, O_2^+, O_2^-, O_2^{--}$

Ans (2)

$O_2^{2-}, O_2^-, O_2, O_2^+$

Increasing bond order: 1.0, 1.5, 2.0, 2.5

50. $3A \longrightarrow 2B$, rate of reaction $+\dfrac{d[B]}{dt}$ is equal to

(1) $-\dfrac{2}{3}\dfrac{d[A]}{dt}$ (2) $-\dfrac{1}{3}\dfrac{d[A]}{dt}$ (3) $-\dfrac{3}{2}\dfrac{d[A]}{dt}$ (4) $+2\dfrac{d[A]}{dt}$

Ans (1)

$$-\frac{1}{3}\frac{d[A]}{dt} = +\frac{1}{2}\frac{d[B]}{dt}$$

$$\therefore +\frac{d[B]}{dt} = -\frac{2}{3}\frac{d[A]}{dt}$$

51. The hybridisation of C in diamond, graphite and ethyne is in the order

(1) sp^3, sp^2, sp (2) sp^2, sp^3, sp (3) sp^3, sp, sp^2 (4) sp, sp^2, sp^3

Ans (1)

52. In the reaction; $Fe(OH)_{3(s)} \rightleftharpoons Fe^{3+}_{(aq)} + 3OH^-_{(aq)}$, if the concentration of OH^- ions is decreased by $\dfrac{1}{4}$ times, then the equilibrium concentration of Fe^{3+} will increase by,

(1) 16 times (2) 4 times (3) 8 times (4) 64 times

Ans (4)

64 times

If the concentration of $OH^{\ominus}$ is decreased by $\dfrac{1}{4}$ times, conc. of Fe^{3+} at equilibrium increases by 4^3 times.

53. Van-Arkel method of refining Zirconium involves,

(1) removing CO impurity

(2) removing silica impurity

(3) removing all oxygen and nitrogen impurities.

(4) removing Hydrogen impurity

Ans (3)

Removing all oxygen and nitrogen impurities

54. The activation energy of a chemical reaction can be determined by,

(1) changing the concentration of reactants.

(2) evaluating rate constant at standard temperature.

(3) evaluating rate constants at two different temperatures.

(4) evaluating the concentration of reactants at two different temperatures.

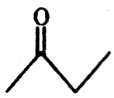
Ans (3)

By evaluating rate constant at two different temperatures.

55. Predict the product 'C' in the following series of reactions:

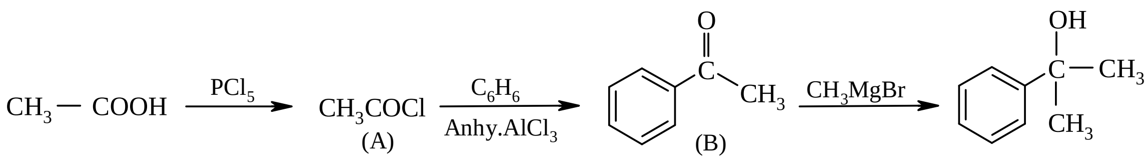
$$CH_3 - COOH \xrightarrow{PCl_5} A \xrightarrow[\text{Anhyd } AlCl_3]{C_6H_6} B \xrightarrow{CH_3MgBr} C$$

(1) $CH_3CH(OH)C_6H_5$ (2) $(CH_3)_2C(OH)C_6H_5$

(3) 

(4) $CH_3CH(OH)C_2H_5$

Ans (2)



56. A liquid can exist only,

(1) At any temperature above melting point. (2) Between boiling and melting points.

(3) Between triple point and critical point. (4) Between melting point and critical point.

Ans (3)

Between triple point and critical point

57. When an electrolyte is dissociated in solution, the van't Hoff's factor (i) is,

(1) < 1 (2) $= 1$ (3) > 1 (4) $= 0$

Ans (3)

>1

58. The shape of XeF_6 is,

(1) Distorted octahedral (2) Pyramidal

(3) Square planar (4) Square pyrimidal

Ans (1)

Distorted octahedral

59. An organic compound contains C = 40%. H= 13.33% and N = 46.67%. Its emperical formula is

(1) C_3H_7N (2) CHN (3) C_2H_2N (4) CH_4N

Ans (4)

CH_4N

	%	**% At mass**		
C	40%	40/12	3.33	1
H	13.33%	13.3	13.33	4
N	46.67%	46.6/14	3.33	1

60. If the bond energies of H–H, Br–Br and H–Br are 433, 192 and 364 kJ mol^{-1} respectively, then ΔH° for the reaction:

$H_{2(g)} + Br_{2(g)} \longrightarrow 2HBr_{(g)}$ is

(1) +103 kJ (2) – 103 kJ (3) –261 kJ (4) +261 kJ

Ans (2)

$\Delta Hr = B.E_{reactants} - B.E$ of products

$= [B.E \text{ of } H\text{–}H + B.E \text{ of } Br_2] - 2 \times B.E \text{ of } HBr$

$= [433 + 192] - 2 \times 364$

$= 625 - 728$

$= -103$

KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
PHYSICS
Test Paper Code : D - 3
KEYS

Q. No.	Keys	Q. No.	Keys	Q. No.	Keys
1.	(4)	21.	(4)	41.	(2)
2.	(3)	22.	(4)	42.	(2)
3.	(1)	23.	(2)	43.	(4)
4.	(2)	24.	(3)	44.	(3)
5.	(4)	25.	(3)	45.	(2)
6.	(3)	26.	(1)	46.	(3)
7.	(1)	27.	(1)	47.	(4)
8.	(3)	28.	(1)	48.	(4)
9.	(4)	29.	(4)	49.	(3)
10.	(2)	30.	(1)	50.	(1)
11.	(3)	31.	(1)	51.	(1)
12.	(3)	32.	(2)	52.	(3)
13.	(2)	33.	(3)	53.	(4)
14.	(2)	34.	(3)	54.	(2)
15.	(1)	35.	(1)	55.	(2)
16.	(4)	36.	(4)	56.	(4)
17.	(1)	37.	(3)	57.	(1)
18.	(2)	38.	(4)	58.	(4)
19.	(1)	39.	(2)	59.	(3)
20.	(1)	40.	(2)	60.	(2)

KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
PHYSICS - SOLUTIONS
Test Paper Code : D - 3

1. Constant DC voltage is required from a variable AC voltage. Which of the following is correct order of operation?
   (1) Rectifier, regulator, filter
   (2) Filter, regulator, rectifier
   (3) Regulator, filter, rectifier
   (4) Rectifier, filter, regulator
   Ans (4)

2. A galvanometer coil has a resistance of 50 Ω and the meter shows full scale deflection for a current of 5 mA. This galvanometer is converted into voltmeter of range 0 – 20 V by connecting
   (1) 4050 Ω in series with galvanometer
   (2) 4050 Ω in parallel with galvanometer
   (3) 3950 Ω in series with galvanometer
   (4) 3950 Ω in parallel with galvanometer
   Ans (3)
   $G = 50\ \Omega$, $I_g = 5\ mA = 0.005\ A$
   $$R = \frac{V}{I_g} - G = \frac{20}{0.005} - 50 = 4000 - 50 = 3950\ \Omega \text{ in series with galvanometer}$$

3. A ray of light suffers a minimum deviation when incident on an equilateral prism of refractive index $\sqrt{2}$. The angle of incidence is
   (1) 45°
   (2) 50°
   (3) 30°
   (4) 60°
   Ans (1)
   $$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$
   $$\sqrt{2} = \frac{\sin\frac{(60+D)}{2}}{\sin\frac{60}{2}}$$
   $$\sqrt{2} = \frac{\sin\left(\frac{60+D}{2}\right)}{\sin 30}$$
   $$\sqrt{2} \times \frac{1}{2} = \sin\left(\frac{60+D}{2}\right)$$
   $$\frac{1}{\sqrt{2}} = \sin\left(\frac{60+D}{2}\right)$$
   $$\frac{60+D}{2} = 45$$
   60 + D = 90
   D = 30

$2i = A + D$

$2i = 60 + 30$

$2i = 90$

$$i = \frac{90}{2}$$

$i = 45°$

4. The de Broglie wavelength of an electron accelerated to a potential of 400 V is approximately

(1) 0.04 nm (2) 0.06 nm (3) 0.03 nm (4) 0.12 nm

Ans (2)

$$\lambda = \frac{h}{\sqrt{2meV}}$$

$$\lambda = \frac{6.625\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times1.6\times10^{-19}\times400}}$$

$$\lambda = \frac{6.625\times10^{-34}}{\sqrt{11648\times10^{-50}}}$$

$$\lambda = \frac{6.625\times10^{-34}}{107.925\times10^{-25}}$$

$$\lambda = 0.06138\times10^{-34+25}$$

$$\lambda = 0.06138\times10^{-9}$$

$$\lambda = 0.06 \text{ nm}$$

5. Two heating coils of resistances 10 Ω and 20 Ω are connected in parallel and connected to a battery of emf 12 V and internal resistance 1 Ω. The power consumed by them are in the ratio

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

Ans (4)

$$P = \frac{V^2}{R}; \qquad P \propto \frac{1}{R}$$

$$\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{20}{10} = \frac{2}{1} \text{ for constant V}$$

6. The component of a vector $\vec{r}$ along x-axis will have a maximum value if

(1) $\vec{r}$ is along + ve y-axis (2) $\vec{r}$ makes an angle of 45° with the x-axis

(3) $\vec{r}$ is along +ve x-axis (4) $\vec{r}$ is along –ve y-axis

Ans (3)

$r_x = r \cos \theta$

r_x is maximum if $\theta = 0°$

7. Mobility of free electrons in a conductor is

(1) directly proportional to relaxation time. (2) inversely proportional to relaxation time.

(3) directly proportional to electron density. (4) inversely proportional to electron density.

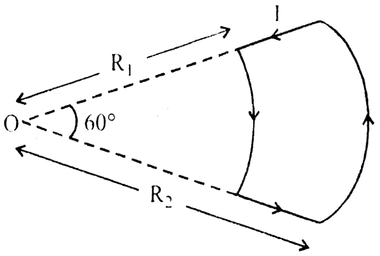
Ans (1)

Electron mobility

$$\mu_e = \frac{e\tau}{m}$$

$$\mu_e \propto \tau$$

8. A conducting wire carrying current is arranged as shown. The magnetic field at 'O'



(1) $\frac{\mu_0 i}{12}\left[\frac{1}{R_1}+\frac{1}{R_2}\right]$ (2) $\frac{\mu_0 i}{6}\left[\frac{1}{R_1}+\frac{1}{R_2}\right]$

(3) $\frac{\mu_0 i}{12}\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$ (4) $\frac{\mu_0 i}{6}\left[\frac{1}{R_1}+\frac{1}{R_2}\right]$

Ans (3)

$$B=\frac{\mu_0 I}{4\pi R}\cdot\theta$$

$$B \propto \frac{1}{R},$$

$$B_1=\frac{\mu_0 I}{4\pi R_1}\left(\frac{\pi}{3}\right)=\frac{\mu_0 I}{12R_1}, \quad B_2=\frac{\mu_0 I}{4\pi R_2}\left(\frac{\pi}{3}\right)=\frac{\mu_0 I}{12R_2}$$

$$B=B_1-B_2=\frac{\mu_0 I}{12}\left[\frac{1}{R_1}-\frac{1}{R_2}\right]$$

9. Three bodies a ring (R), a solid cylinder (C) and a solid sphere (S) having same mass and same radius roll down the inclined plane without slipping. They start from rest, if v_R, v_C and v_S are velocities of respective bodies on reaching the bottom of the plane, then

(1) $v_R > v_C > v_S$ (2) $v_R = v_C > v_S$ (3) $v_R = v_C = v_S$ (4) $v_R < v_C < v_S$

Ans (4)

$$mgh=\frac{1}{2}mv^2+\frac{1}{2}Iw^2$$

$$mgh=\frac{1}{2}mv^2+\frac{1}{2}I\frac{v^2}{R^2}=\frac{1}{2}v^2\left(m+\frac{I}{R^2}\right)$$

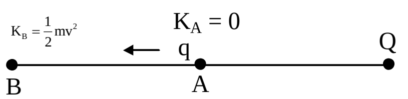
$$v=\sqrt{\frac{2mgh}{\left(m+\frac{I}{R^2}\right)}} \Rightarrow \text{more I, less v}$$

$$\Rightarrow v_R < v_C < v_S$$

10. A particle of mass 1 gm and charge 1 μC is held at rest on a frictionless horizontal surface at distance 1 m from the fixed charge 2 mC. If the particle is released, it will be repelled. The speed of the particle when it is at a distance of 10 m from the fixed charge

(1) 100 ms^{-1} (2) 180 ms^{-1} (3) 60 ms^{-1} (4) 90 ms^{-1}

Ans (2)



Change in kinetic energy = work done by electric field

$$\frac{1}{2}mv^2-0=(V_A-V_B)q=\frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r_1}-\frac{1}{r_2}\right]\times q$$

$$\frac{1}{2}\times10^{-3}\times v^2=9\times10^9\left[1-\frac{1}{10}\right]\times10^{-6}\times2\times10^{-3}$$

v = 180 ms^{-1}

11. An electron of mass m, charge e falls through a distance h meter in a uniform electric field E. Then time of fall

(1) $t = \frac{2hm}{eE}$ (2) $t = \frac{2eE}{hm}$ (3) $t = \sqrt{\frac{2hm}{eE}}$ (4) $t = \sqrt{\frac{2eE}{hm}}$

Ans (3)

$t = \sqrt{\frac{2h}{a}} = \sqrt{\frac{2h\,m}{eE}} \qquad \left[\because a = \frac{eE}{m}\right]$

12. A particle executing SHM has a maximum speed of 0.5 ms^{-1} and maximum acceleration of 1.0 ms^{-2}. The angular frequency of oscillation is

(1) 0.5 rad s^{-1} (2) 0.5 π rad s^{-1} (3) 2 rad s^{-1} (4) 2π rad s^{-1}

Ans (3)

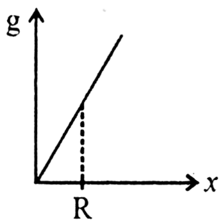
$\frac{v_{max}}{a_{max}} = \frac{A\omega}{A\omega^2} = \frac{0.5}{1} \Rightarrow \omega = 2\ \text{rads}^{-1}$

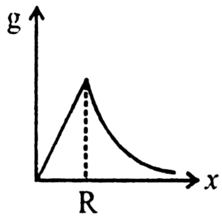
13. The process of super imposing message signal on high frequency carrier wave is called

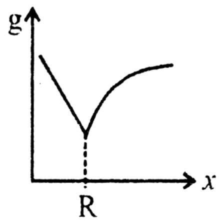
(1) Demodulation (2) Modulation (3) Amplification (4) Transmission

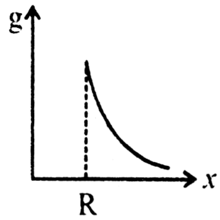
Ans (2)

14. Variation of acceleration due to gravity (g) with distance x from the centre of the earth is best represented by (R $\rightarrow$ Radius of the earth)

(1) 

(2) 

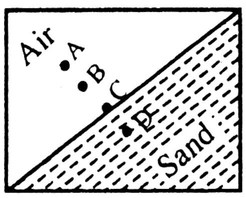
(3) 

(4) 

Ans (2)

15. Which of the points is likely position of the centre of mass of the system shown in the figure?

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



Ans (1)

16. A body falls freely for 10 sec. Its average velocity during this journey (take g = 10 ms^{-2})

(1) 10 ms^{-1} (2) 5 ms^{-1} (3) 100 ms^{-1} (4) 50 ms^{-1}

Ans (4)

Average velocity $= \frac{\text{total distance}}{\text{total time taken}}$

$= \frac{1}{2}gt^2 / t$

$= 50\ ms^{-1}$

17. A wheel with 10 spokes each of length 'L' m is rotated with a uniform angular velocity 'ω' in a plane normal to the magnetic field 'B'. The emf induced between the axle and the rim of the wheel.

(1) $\frac{1}{2}\omega BL^2$ (2) $N\omega BL^2$ (3) $\frac{1}{2}N\omega BL^2$ (4) ωbL^2

Ans (1)

Emf induced is independent of number of spokes.

18. A proton is projected with a uniform velocity 'v' along the axis of a current carrying solenoid, then

(1) the proton path will be circular about the axis.

(2) the proton will continue to move with velocity 'v' along the axis.

(3) the proton will be accelerated along the axis.

(4) the proton move along helical path.

Ans (2)

Angle between $\vec{v}$ and $\vec{B} = 0$. So, $\vec{v} \times \vec{B} = 0$

19. χ_1 and χ_2 are susceptibility of a paramagnetic material at temperatures T_1K and T_2K respectively, then

(1) $\chi_1 T_1 = \chi_2 T_2$ (2) $\chi_1\sqrt{T_1} = \chi_2\sqrt{T_2}$ (3) $\chi_1 = \chi_2$ (4) $\chi_1 T_2 = \chi_2 T_1$

Ans (1)

$$\chi \propto \frac{1}{T} \Rightarrow \frac{\chi_1}{\chi_2} = \frac{T_2}{T_1}$$

20. The quantity of a charge that will be transferred by a current flow of 20 A over 1 hour 30 minutes period is

(1) 10.8×10^4 C (2) 1.8×10^4 C (3) 10.8×10^3 C (4) 5.4×10^3 C

Ans (1)

$q = It$

$= 20 \times 5400 = 108000 = 10.8 \times 10^4$ C

21. A source of sound is moving with a velocity of 50 ms^{-1} towards a stationary observer. The observer measures the frequency of sound as 500 Hz. The apparent frequency of sound as heard by the observer when source is moving away from him with the same speed is (Speed of sound at room temperature 350 ms^{-1})

(1) 666 Hz (2) 177.5 Hz (3) 400 Hz (4) 375 Hz

Ans (4)

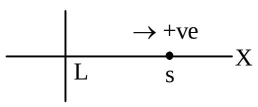
$v_L = 0$, $v_s = -50$ ms^{-1}, $f_{app} = 500$ Hz (source towards the listener)

$f'_{app} = ?$ (source away from the listener)

$v = v_{sound} = 350$ ms^{-1}

- General formula: $f_{app} = f_{true}\left(\frac{v + v_L}{v + v_s}\right)$

Convention



L = listener (observer)

s = source

- Case (i): Source towards the listener

$$f_{app} = f_{true}\left(\frac{v + 0}{v - v_s}\right) \quad \ldots (1)$$

- Case (ii): Source away from the listener

$$f'_{app} = f_{true}\left(\frac{v+0}{v+v_s}\right) \qquad \ldots (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{f_{app}}{f'_{app}} = \frac{v+v_s}{v-v_s}$$

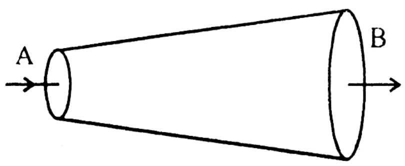
$$\frac{500}{f'_{app}} = \frac{350+50}{350-50} = \frac{400}{300} = \frac{4}{3}$$

$$f'_{app} = 500 \times \frac{3}{4} = 375 \text{ Hz}$$

22. A spring is stretched by applying a load to its free end. The strain produced in the spring is
(1) Shear (2) Longitudinal (3) Volumetric (4) Longitudinal & Shear
Ans (4)
Longitudinal and shear

23. In Young's double slit experiment the source is white light. One slit is covered with red filter and the other with blue filter. There shall be
(1) Alternate dark & pink fringes (2) No interference
(3) Alternate red & blue fringes (4) Alternate dark & yellow fringes
Ans (2)
No interference

24. An ideal fluid flows through a pipe of circular cross section with diameters 5 cm and 10 cm as shown. The ratio of velocities of fluid at A and B is
(1) 1 : 4
(2) 1 : 2
(3) 4 : 1
(4) 2 :1



Ans (3)
Equation of continuity: $A_A v_A = A_B v_B$

$$\frac{v_A}{v_B} = \frac{A_B}{A_A} = \frac{\frac{\pi(10)^2}{4}}{\frac{\pi(5)^2}{4}} = \frac{100}{25} = 4$$

25. A long solenoid with 40 turns per cm carries a current of 1 A. The magnetic energy stored per unit volume is _________ J/m^3.
(1) 32 π (2) 6.4 π (3) 3.2 π (4) 1.6 π
Ans (3)

$$n = \frac{40}{(10^{-2})} = 4\times10^3 \text{ / metre, } B \text{ (long solenoid)} = \mu_0 nI$$

$$\text{Energy per unit volume} = \frac{1}{2\mu_0}B^2 = \frac{1}{2\mu_0}(\mu_0 nI)^2 = \frac{\mu_0 n^2 I^2}{2}$$

$$= \frac{4\pi\times10^{-7}\times(4\times10^3)^2\times(1)^2}{2}$$

$$= 32\pi \times 10^{-1} = 3.2\,\pi \text{ Jm}^{-3}$$

26. Nature of equipotential surface for a point charge is

(1) sphere with charge at the centre of the sphere.

(2) plane with charge on the surface.

(3) ellipsoid with charge at foci.

(4) sphere with charge on the surface of the sphere.

Ans (1)

Equipotential surfaces are concentric spheres, with the point charge at the centre.

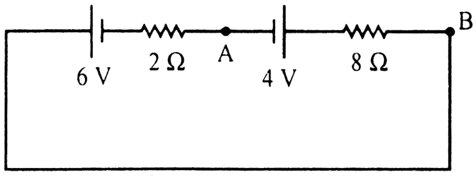
27. Potential difference between A and B in the following circuit

(1) 5.6 V

(2) 6 V

(3) 4 V

(4) 2.8 V



Ans (1)

$$I = \frac{(6-4)}{(2+8)} = 0.2\ \text{A}$$

$V_B - (0.2 \times 8) - 4 = V_A \Rightarrow V_B - V_A = 5.6$ V

OR

$V_B - 6 + (0.2 \times 2) = V_A \Rightarrow V_B - V_A = 5.6$ V

28. For what distance is ray optics is good approximation when the aperture is 4 mm and the wavelength of light is 400 nm?

(1) 40 m (2) 30 m (3) 24 m (4) 18 m

Ans (1)

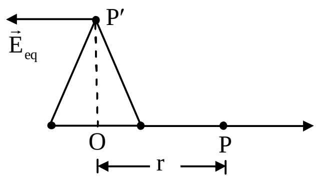
Fresnel's distance, $Z = \frac{a^2}{\lambda} = \frac{(4\times10^{-3})^2}{400\times10^{-9}} = \frac{16\times10^{-6}}{4\times10^{-7}} = 40$ m

29. If $\vec{E}_{ax}$ and $\vec{E}_{eq}$ represents electric field at a point on the axial and equatorial line of a dipole. If points are at a distance r from the centre of the dipole, for r >> a

(1) $\vec{E}_{ax} = -\vec{E}_{eq}$ (2) $\vec{E}_{eq} = 2\vec{E}_{ax}$ (3) $\vec{E}_{ax} = \vec{E}_{eq}$ (4) $\vec{E}_{ax} = -2\vec{E}_{eq}$

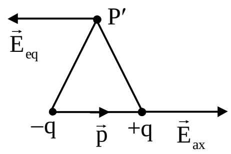
Ans (4)

For a short dipole (r >> a): $\vec{E}_{ax} = -2\vec{E}_{eq}$



$$|\vec{E}_{ax}| = \left(\frac{1}{4\pi\varepsilon_0}\right)\frac{2p}{r^3}$$

$$|\vec{E}_{eq}| = \left(\frac{1}{4\pi\varepsilon_0}\right)\frac{p}{r^3}$$



30. In a series L.C.R. circuit an alternating emf (v) and current (i) are given by the equation $v = v_0 \sin \omega t, i = i_0 \sin\left(\omega t + \frac{\pi}{3}\right)$

The average power dissipated in the circuit over a cycle of AC is

(1) $\frac{v_0 i_0}{4}$ (2) zero (3) $\frac{v_0 i_0}{2}$ (4) $\frac{\sqrt{3}}{2} v_0 i_0$

Ans (1)

ϕ = phase difference between V and $I = \frac{\pi}{3}$

$P_{ave} = V_{rms}\, I_{rms} \cos\phi$

$$= \left(\frac{V_0}{\sqrt{2}}\right)\left(\frac{I_0}{\sqrt{2}}\right)\cos\left(\frac{\pi}{3}\right) = \frac{V_0 I_0}{2} \times \frac{1}{2} = \frac{V_0 I_0}{4}$$

31. Total energy of electron in an excited state of hydrogen atom is –3.4 eV. The kinetic and this state potential energy of electron in this state

(1) K = 3.4 eV U = –6.8 eV

(2) K = + 10.2 eV U = –13.6 eV

(3) K = –3.4 eV U = –6.8 eV

(4) K= –6.8 eV U = +3.4 eV

Ans (1)

$$K = \frac{Ze}{8\pi\varepsilon_0 r} \text{ (eV)}$$

$$U = \frac{-ze}{4\pi\varepsilon_0 r} \text{ (eV)} = 2E_n$$

$$E_n = \frac{-ze}{8\pi\varepsilon_0 r}$$

32. In a series L.C.R circuit, the potential drop across L, C and R respectively are 40 V, 120 V and 60 V. Then the source voltage is

(1) 160 V (2) 100 V (3) 220 V (4) 180 V

Ans (2)

$$V = \sqrt{V_R^2 + \left(V_C - V_L\right)^2}$$

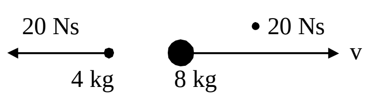
$$= \sqrt{60^2 + (120-40)^2}$$

V = 100 volt

33. A 12 kg bomb at rest explodes into two pieces of 4 kg and 8 kg. If the momentum of 4 kg piece is 20 Ns, the kinetic energy of the 8 kg piece is

(1) 20 J (2) 40 J (3) 25 J (4) 50 J

Ans (3)



Law of conservation of momentum

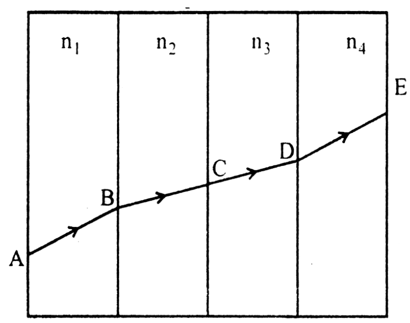
$8 \times v = 20$

$$v = \frac{20}{8} = 2.5 \text{ m s}^{-1}$$

K.E. of 8 kg piece,

$$K = \frac{1}{2}mv^2 = \frac{1}{2} \times 8 \times (2.5)^2 = 25 \text{ J}$$

34. A ray of light passes through four transparent media with refractive index n_1, n_2, n_3 and n_4 as shown. The surfaces of all media are parallel



If the emergent ray DE is parallel to incident ray AB, then

(1) $n_2 = n_4$ (2) $n_1 = \frac{n_2 + n_3 + n_4}{3}$ (3) $n_1 = n_4$ (4) $n_3 = n_4$

Ans (3)

$n_1 = n_4$ as DE is parallel to AB

35. A Carnot engine working between 300 K and 400 K has 800 J of useful work. The amount of heat energy supplied to the engine from the source is

(1) 3200 J (2) 3600 J (3) 2400 J (4) 1200 J

Ans (1)

$\eta = 1 - \frac{T_2}{T_1}$ and $\eta = \frac{W}{Q_1}$ $\Rightarrow \frac{W}{Q_1} = 1 - \frac{T_2}{T_1}$

$\frac{800}{Q_1} = 1 - \frac{300}{400}$

$Q_1 = 3200$ J

36. When electron jumps from n = 4 level to n = 1 level, the angular momentum of electron changes by

(1) $\frac{2h}{2\pi}$ (2) $\frac{4h}{2\pi}$ (3) $\frac{h}{2\pi}$ (4) $\frac{3h}{2\pi}$

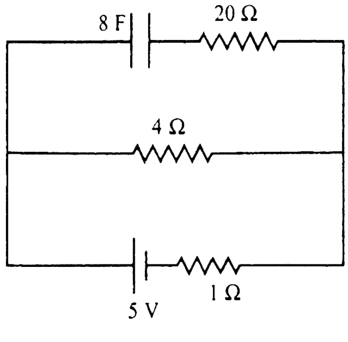
Ans (4)

$L_1 = 1 \times \frac{h}{2\pi}$ when n = 1

$L_2 = 4 \times \frac{h}{2\pi}$ when n = 4

$L_2 - L_1 = \frac{3h}{2\pi}$

37. A capacitor of 8 F is connected as shown. Charge on the plates of the capacitor



(1) 40 C

(2) 80 C

(3) 32 C

(4) 0 C

Ans (3)

The capacitor is in steady state.

No current flows through 20 Ω

Voltage across capacitor = voltage across 4 Ω

$$= IR = \frac{E}{R_e + r} \cdot R = \frac{5}{4+1} \times 4 = 4 \text{ volt}$$

Charge on capacitor, $Q = CV = 8 \times 4 = 32$ C

38. Electromagnetic radiation used to sterilise milk is

(1) γ-ray (2) Radio-waves (3) X-ray (4) UV rays

Ans (4)

UV-rays are used for sterilization

39. If there are only one type of charge in the universe, then

($\vec{E} \to$ Electric field, $\overrightarrow{ds} \to$ Area vector)

(1) $\oint \vec{E} \cdot \overrightarrow{ds}$ could not be defined

(2) $\oint \vec{E} \cdot ds = 0$ if charge is outside,

$= \frac{q}{\epsilon_0}$ if charge is inside

(3) $\oint \vec{E} \cdot \overrightarrow{ds} \neq 0$ on any surface

(4) $\oint \vec{E} \cdot ds = \infty$ if charge is inside

Ans (2)

$\vec{E} \cdot \overrightarrow{ds} \neq 0$ on any surface

If charge is outside the surface, incoming flux = outgoing flux. Net flux through surface = 0

If charge is inside, flux only goes one way.

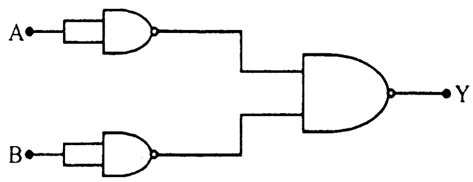
40. Identify the logic operation carried out by the following circuit.

(1) NAND

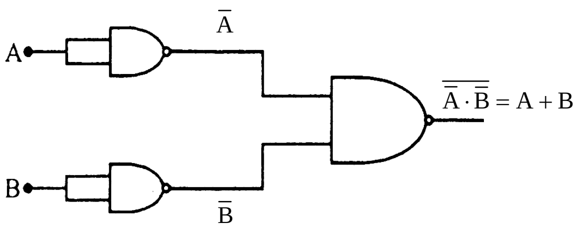
(2) OR

(3) AND

(4) NOR



Ans (2)



The given logical circuit represents OR gate.

41. A plane glass plate is placed over a various coloured letters (violet, green, yellow, red). The letter which appears to raised more

(1) Yellow (2) Violet (3) Red (4) Green

Ans (2)

$S_N = t\left(1 - \frac{1}{n}\right)$ As n increases, $\frac{1}{n}$ decreases and $\left(1 - \frac{1}{n}\right)$ increases.

$\therefore$ S_N is more for that colour, for which n is more.

Among the given colours n is more for violet. Therefore it appears to be raised more.

42. Three projectiles A, B and C are projected at an angle of 30°, 45°, 60° respectively. If R_A, R_B and R_C are ranges of A, B and C respectively, then (velocity of projection is same for A, B and C)

(1) $R_A = R_C > R_B$ (2) $R_A = R_C < R_B$ (3) $R_A = R_B = R_C$ (4) $R_A < R_B < R_C$

Ans (2)

Range is maximum for 45° $\therefore$ B has maximum range.

Range is same for both 30° and 60° as they are complementary angles.

$\therefore R_A = R_C < R_B$

43. The rms value of current in a 50 Hz AC circuit is 6 A. The average value of AC current over a cycle is

(1) $\frac{3}{\pi\sqrt{2}}$ (2) $\frac{6}{\pi\sqrt{2}}$ (3) $6\sqrt{2}$ (4) Zero

Ans (4)

Average value of AC over a cycle is zero.

44. A radio-active sample of half-life 10 days contains 1000 x nuclei. Number of original nuclei present after 5 days is

(1) 750 x (2) 250 x (3) 707 x (4) 500 x

Ans (3)

$$N = \frac{N_0}{2^n}$$

Here $n = \frac{1}{2}$ and N_0 = 1000 x

$$\therefore N = \frac{1000x}{2^{\frac{1}{2}}} = \frac{1000x}{\sqrt{2}} = 0.707 \times 1000x$$

N = 707 x

45. An element X decays into element Z by two-step process.

$$X \longrightarrow Y + {}_2^4He$$

$$Y \longrightarrow Z + 2\bar{e} \text{ then}$$

(1) X & Y are isotopes. (2) X & Z are isotopes.

(3) X & Z are isobars. (4) X & Z are isotones.

Ans (2)

Let A and Z be the mass number and atomic number of X respectively.

$${}_Z^AX \xrightarrow{\alpha-\text{decay}} {}_{Z-2}^{A-4}Y + {}_2^4He$$

$${}_{Z-2}^{A-4}Y \xrightarrow{\beta-\text{decay}} {}_Z^{A-4}Z + 2\ {}_{-1}e^0$$

$\therefore$ X and Z are isotopes.

46. A capacitor of capacitance 10 μF is connected to an AC source and an AC Ammeter, if the source voltage varies as V = $50\sqrt{2}$ sin 100 t, the reading of the ammeter is

(1) 70.7 mA (2) 7.07 mA (3) 50 mA (4) 5.0 mA

Ans (3)

$V = 50\sqrt{2}\sin 100t$

Comparing with $V = V_0 \sin \omega t$

$V_0 = 50\sqrt{2}$ V, $\omega = 100$

$$\therefore\ V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{50\sqrt{2}}{\sqrt{2}} = 50\text{ V}$$

$$X_C = \frac{1}{\omega C} = \frac{1}{100\times 10\times 10^{-6}} = 10^3 = 1000\,\Omega$$

$$\therefore\ I_{rms} = \frac{V_{rms}}{X_C} = \frac{50}{1000} = 50\text{ mA } = \text{Ammeter reading}$$

[Note: Ammeter reads rms value of current]

47. Four metal plates are arranged as shown. Capacitance between X and Y

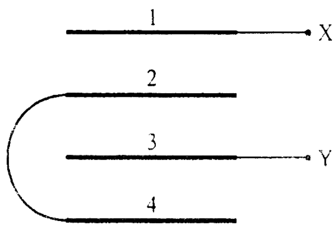
(A $\rightarrow$ Area of each plate, d $\rightarrow$ distance between the plates)

(1) $\frac{2\in_0 A}{d}$

(2) $\frac{3\in_0 A}{d}$

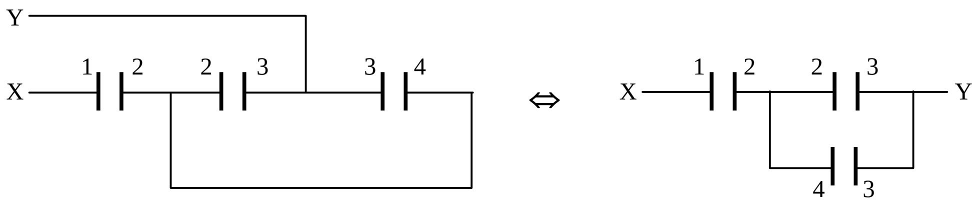
(3) $\frac{3}{2}\frac{\in_0 A}{d}$

(4) $\frac{2}{3}\frac{\in_0 A}{d}$



Ans (4)

The given circuit can be rewritten as follows.

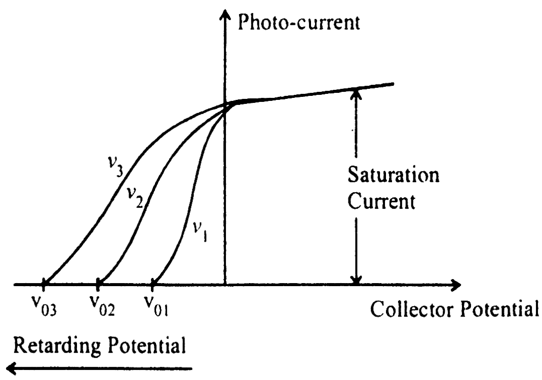


$\therefore$ Two capacitors are in parallel. Combination is in series with the third

$\therefore$ C_{eff} = C (series) C_P = C(series) 2C

$$\therefore\ C_{eff} = \frac{C(2C)}{C+2C} = \frac{2C}{3} = \frac{2}{3}\frac{\varepsilon_0 A}{d}$$

48. The variation of photo-current with collector potential for different frequencies of incident radiation ν_1, ν_2, and ν_3 is as shown in the graph, then



(1) $\nu_1 > \nu_2 > \nu_3$

(2) $\nu_3 = \frac{\nu_1 + \nu_2}{2}$

(3) $\nu_1 = \nu_2 = \nu_3$

(4) $\nu_1 < \nu_2 < \nu_3$

Ans (4)

Stopping potential is directly proportional to incident frequency.

Therefore $\nu_1 < \nu_2 < \nu_3$.

49. Light of wavelength 600 nm is incident normally on a slit of width 0.2 mm. The angular width of central maxima in the diffraction pattern is
(measured from minimum to minimum)

(1) 4×10^{-3} rad (2) 4.5×10^{-3} rad (3) 6×10^{-3} rad (4) 2.4×10^{-3} rad

Ans (3)

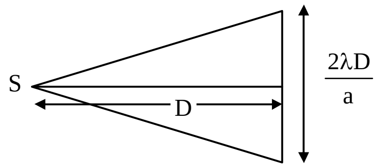
Linear width of central maxima is = $\frac{2\lambda D}{a}$

Angular width of central maxima is = $\frac{\frac{2\lambda D}{a}}{D}$

$= \frac{2\lambda}{a}$

$= \frac{2 \times 6 \times 10^{-7}}{2 \times 10^{-4}}$

$= 6 \times 10^{-3}$ rad



50. A pan filled with hot food cools from 94 °C to 86 °C in 2 minutes. When the room temperature is 20 °C. How long will it cool from 74 °C to 66 °C?

(1) 2.8 minutes (2) 1.8 minutes (3) 2 minutes (4) 2.5 minutes

Ans (1)

From Newton's law of cooling, $\frac{d\theta}{dt} \propto (\theta - \theta_0)$

In Case (i), $\frac{94-86}{2} \propto \left(\frac{94+86}{2} - 20\right)$

$\Rightarrow \frac{8}{2} \propto (90 - 20)$

or $4 \propto 70$ … (1)

In Case (ii), $\frac{74-66}{t} \propto \left(\frac{74+66}{2} - 20\right)$

$\frac{8}{t} \propto (70 - 20)$

$\frac{8}{t} \propto 50$ … (2)

Dividing (1) and (2)

$\frac{t}{2} = \frac{70}{50}$

$t = \frac{14}{5}$

t = 2.8 minutes

51. A nucleus of mass 20 u emits a γ photon of energy 6 MeV. If the emission assume to occur when nucleus is free and rest, then the nucleus will have kinetic energy nearest to (take 1u = 1.6×10^{-27} kg)

(1) 1 KeV (2) 100 KeV (3) 10 KeV (4) 0.1 KeV

Ans (1)

By conservation of linear momentum

Momentum of photon = momentum of nucleus

$$\frac{E}{c} = \sqrt{2m(KE)}$$

$$\frac{6\times10^{6}\times1.6\times10^{-19}}{3\times10^{8}} = \sqrt{2\times20\times1.6\times10^{-27}\times KE}$$

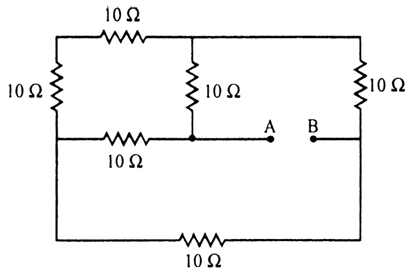
$$3.2\times10^{-21} = \sqrt{64\times10^{-27}\times KE}$$

$$\frac{(3.2)^2\times10^{-42}}{64\times10^{-27}} = KE$$

KE = 1.6×10^{-16} J

$$KE = \frac{1.6\times10^{-16}}{1.6\times10^{-19}} eV = 10^3\ eV = 1\ keV$$

52. Effective resistance between A and B in the following circuit



(1) 20 Ω   (2) $\frac{20}{3}\Omega$ (3) 10 Ω   (4) 5 Ω

Ans (3)

Circuit can be redrawn as

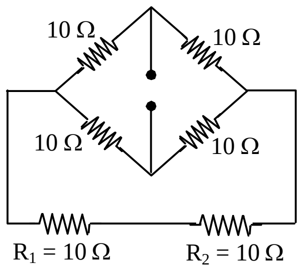


Figure (1)

R_1 and R_2 are resistances given at left most top edges of the diagram in question.

Figure (1) resembles a circuit of Wheat Stone Bridge in which battery and central branch resistance are interchanged and circuit satisfies

$$\frac{P}{Q} = \frac{R}{S}$$

Since the adjacent diagram satisfies $\frac{P}{Q} = \frac{R}{S}$,

no current flows through R_1 and R_2.

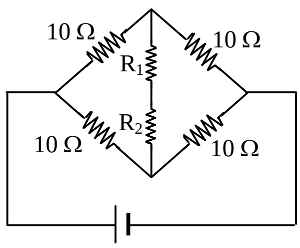


Figure (2)

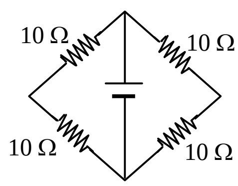
We go back to original diagram figure (1).

If we connect battery between A and B,

no current flows through R_1 and R_2.

R_{eff} = (10 Ω + 10 Ω) | | (10 Ω + 10λ)

= 10 Ω



53. In the cyclotron, as radius of the circular path of the charged particle increases
(ω = angular velocity, v = linear velocity)

(1) ω only increases v remains constant
(2) v increases, ω decreases
(3) both ω and v increases
(4) v increases, ω remains constant

Ans (4)

$$Bqv = \frac{mv^2}{r}$$

$$v = \left(\frac{Bq}{m}\right)r$$ As r increases, v increases.

$$\omega = \frac{v}{r} = \frac{Bq}{m} = \text{ constant (if mass is taken constant)}$$

54. Four rods with different radii r and length l are used to connect two heat reservoirs at different temperature. Which one will conduct most heat?

(1) $r = 1\text{ cm},\ l = \frac{1}{2}\text{m}$
(2) $r = 2\text{ cm},\ l = \frac{1}{2}\text{m}$
(3) r = 1 cm, l = 1 m
(4) r = 2 cm, l = 2 m

Ans (2)

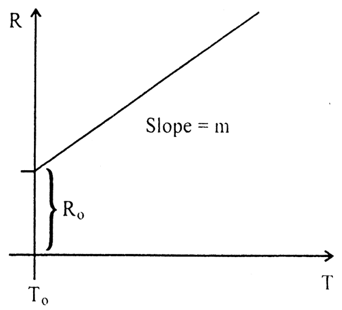
$$H = \frac{KAd\theta}{L} \propto \frac{A}{L} = \frac{\pi r^2}{L}$$

$$\left(\frac{A}{L}\right)_1 = \frac{\pi(1)^2}{\frac{1}{2}} = 2\pi \text{ units} \qquad \left(\frac{A}{L}\right)_2 = \frac{\pi(2)^2}{\frac{1}{2}} = 8\pi \text{ units}$$

$$\left(\frac{A}{L}\right)_3 = \frac{\pi(1)^2}{1} = \pi \text{ units} \qquad \left(\frac{A}{L}\right)_4 = \frac{\pi(2)^2}{2} = 2\pi \text{ units}$$

So rod (2) will conduct most heat per second.

55. Variation of resistance of the conductor with temperature is as shown



The temperature co-efficient (α) of the conductor is

(1) mR_0
(2) $\frac{m}{R_0}$
(3) $\frac{R_0}{m}$
(4) m^2R_0

Ans (2)

$R = R_0(1 + \alpha\Delta T)$ …(1)

From the graph, equation of line is

$R = R_0 + m(T - T_0) = R_0 + m(\Delta T)$ …(2)

From (1) and (2), $R_0\,\alpha\,(\Delta T) = m(\Delta T)$

$$\alpha = \frac{m}{R_0}$$

56. Focal length of a convex lens is 20 cm and its RI is 1.5. It produces an erect, enlarged image if the distance of the object from the lens is

(1) 30 cm (2) 20 cm (3) 40 cm (4) 15 cm

Ans (4)

Given f = 20 cm

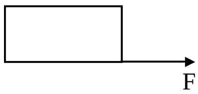
If | u | < f erect and enlarged image will be formed by convex lens. So, u = 15 cm is correct.

57. Maximum acceleration of the train in which a 50 kg box lying on its floor will remain stationary (Given: Co-efficient of static friction between the box and the train's floor is 0.3 and g = 10 m s^{-2})

(1) 3.0 m s^{-2} (2) 15 m s^{-2} (3) 5.0 m s^{-2} (4) 1.5 m s^{-2}

Ans (1)

Friction accelerates the box.



F = ma

But $F_{max} = \mu mg$

So $F_{max} = ma_{max}$

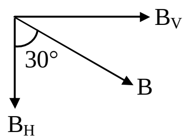
$\mu mg = ma_{max}$

$a_{max} = \mu g = 0.3 \times 10 = 3$ m/s^2

58. At a certain place, the horizontal component of earth's magnetic field is 3.0 G and the angle dip at that place is 30°. The magnetic field of earth at that location

(1) 5.1 G (2) 6.0 G (3) 4.5 G (4) 3.5 G

Ans (4)



$B_H = 3$ G

B cos 30° = 3

B = 3 sec 30°

$$= 3 \times \frac{2}{\sqrt{3}} = \frac{6}{1.732} \Rightarrow B \sim 3.5 \text{ G}$$

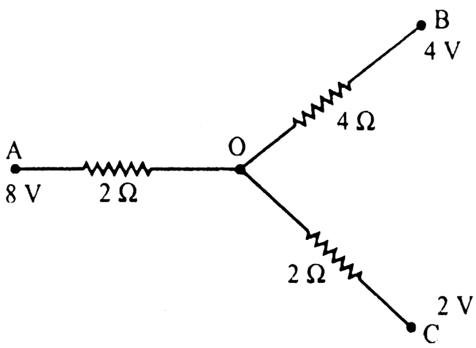
59. In a transistor, the collector current varies by 0.49 mA and emitter current varies by 0.50 mA. Current gain β measured is

(1) 150 (2) 100 (3) 49 (4) 99

Ans (3)

$$\beta = \frac{\Delta I_C}{\Delta I_B} = \frac{\Delta I_C}{\Delta I_E - \Delta I_C} = \frac{0.49 \text{ mA}}{0.50 \text{ mA} - 0.49 \text{ mA}} = \frac{0.49}{0.01} = 49$$

60. In the following network potential at 'O'



(1) 3 V (2) 4.8 V (3) 4 V (4) 6 V

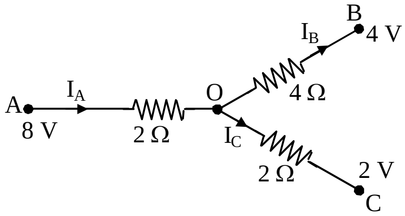
Ans (2)

$I_A = I_B + I_C$ …(1)

$8 - 2I_A = V_0$ …(2)

$V_0 - 4I_B = 4$ …(3)

$V_0 - 2I_C = 2$ …(4)



From (2), $I_A = \dfrac{8 - V_0}{2}$

From (3), $I_B = \dfrac{V_0 - 4}{4}$

From (4), $I_C = \dfrac{V_0 - 2}{2}$

Using all these in (1),

$$\frac{8 - V_0}{2} = \frac{V_0 - 4}{4} + \frac{V_0 - 2}{2}$$

$\Rightarrow V_0 = 4.8$ V

KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
MATHEMATICS
Test Paper Code : D - 3
KEYS

Q. No.	Keys	Q. No.	Keys	Q. No.	Keys
1.	4	21.	3	41.	3
2.	4	22.	1	42.	3
3.	1	23.	3	43.	4
4.	3	24.	2	44.	1
5.	4	25.	1	45.	3
6.	1	26.	1	46.	4
7.	1	27.	3	47.	1
8.	1	28.	2	48.	4
9.	2	29.	2	49.	2
10.	2	30.	2	50.	4
11.	2	31.	2	51.	2
12.	4	32.	4	52.	4
13.	3	33.	1	53.	3
14.	4	34.	4	54.	2
15.	1	35.	1	55.	1
16.	2	36.	3	56.	**Question not clear**
17.	1	37.	2	57.	2
18.	3	38.	4	58.	2
19.	4	39.	3	59.	3
20.	**Question not clear**	40.	4	60.	2

KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
MATHEMATICS - SOLUTIONS
Test Paper Code : D - 3

1. If cos α, cos β, cos γ are the direction cosines of a vector $\vec{a}$, then cos 2α + cos 2β + cos 2γ is equal to

   (1) 3 (2) 0 (3) 2 (4) -1

   Ans (4)

2. The maximum value of $\left(\frac{1}{x}\right)^x$ is

   (1) e^e (2) $\left(\frac{1}{e}\right)^e$ (3) e (4) $e^{1/e}$

   Ans (4)

   $y = \left(\frac{1}{x}\right)^x$

   log y = $-$ x log x

   $\frac{1}{y}.y_1 = -\left[x.\frac{1}{x} + \log x\right]$

   $y_1 = -y(1 + \log x)$

   $y_1 = 0 \Rightarrow \log_e x = -1 \Rightarrow x = e^{-1} = \frac{1}{e}$

   $\therefore\ y = e^{1/e}$

3. Two cards are drawn at random from a pack of 52 cards. The probability of these two being 'Aces' is

   (1) $\frac{1}{221}$ (2) $\frac{1}{13}$ (3) $\frac{1}{26}$ (4) $\frac{1}{2}$

   Ans (1)

   $\frac{{}^4C_2}{{}^{52}C_2} = \frac{1}{221}$

4. If $A = \begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ and $A + A^T = I$, where I is the unit matrix of 2 × 2 and A^T is the transpose of A, then the value of θ is equal to

   (1) $\frac{\pi}{3}$ (2) $\frac{3\pi}{2}$ (3) $\frac{\pi}{6}$ (4) π

   Ans (3)

   $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix} + \begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

   $2\cos 2\theta = 1 \Rightarrow \cos 2\theta = \frac{1}{2} \Rightarrow 2\theta = \frac{\pi}{3} \Rightarrow \theta = \frac{\pi}{6}$

5. $\lim_{x\to0}\frac{xe^x-\sin x}{x}$ is equal to

(1) 1 (2) 2 (3) 3 (4) 0

Ans (4)

$$\lim_{x\to0}\frac{x.e^x+e^x-\cos x}{1}=\frac{0+1-1}{1}=0$$

6. Let * be a binary operation defined on R by $a*b=\frac{a+b}{4}$ $\forall$ a, b $\in$ R then the operation * is

(1) commutative but not associative (2) neither associative nor commutative

(3) commutative and associative (4) associative but not commutative

Ans (1)

7. The differential coefficient of $\log_{10} x$ with respect to $\log_x 10$ is

(1) $-(\log_{10} x)^2$ (2) $\frac{x^2}{100}$ (3) 1 (4) $(\log_x 10)^2$

Ans (1)

$y = \log_{10} x$, $z = \log_x 10$

$y.z = 1$

$$y.1+z.\frac{dy}{dz}=0$$

$$\frac{dy}{dz}=-\frac{y}{z}=-\frac{\log_{10}x}{\log_x 10}=-\left(\log_{10}x\right)^2$$

8. The two curves $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 = 2$

(1) cut each other at right angle (2) cut at an angle $\frac{\pi}{4}$

(3) touch each other (4) cut at an angle $\frac{\pi}{3}$

Ans (1)

$$m_1=-\left(\frac{3x^2-3y^2}{-6xy}\right),\quad m_2=-\left(\frac{6xy}{3x^2-3y^2}\right)$$

$m_1.m_2 = -1$

9. If x, y, z are all different and not equal to zero and $\begin{vmatrix}1+x & 1 & 1\\ 1 & 1+y & 1\\ 1 & 1 & 1+z\end{vmatrix}=0$, then the value of $x^{-1} + y^{-1} + z^{-1}$ is equal to

(1) $x^{-1}\,y^{-1}\,z^{-1}$ (2) -1 (3) xyz (4) $-x-y-z$

Ans (2)

$$\begin{vmatrix}1+x & 1 & 1\\ -x & y & 0\\ 0 & -y & z\end{vmatrix}=0$$

$(1 + x)(yz) - 1(-xz) + 1(xy) = 0$

$yz + xyz + xz + xz = 0$

$$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}+1=0$$

10. The value of $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \left(\sin^{103} - x.\cos^{101} x\right) dx$ is

(1) $\left(\frac{\pi}{4}\right)^{101}$ (2) 0 (3) $\left(\frac{\pi}{4}\right)^{103}$ (4) 2

Ans (2)

$\int_{-a}^{a} f(x)dx = 0$

$\because$ $f(x)$ is an odd function.

11. If $2\vec{a}.\vec{b} = |\vec{a}|.|\vec{b}|$ then the angle between $\vec{a}$ and $\vec{b}$ is

(1) 0° (2) 60° (3) 30° (4) 90°

Ans (2)

Given $2\vec{a}\cdot\vec{b} = |\vec{a}|\,|\vec{b}|$

$\Rightarrow 2\,|\vec{a}|\,|\vec{b}|\cos\theta = |\vec{a}|\,|\vec{b}|$

$\Rightarrow \cos\theta = \frac{1}{2}$

$\Rightarrow \theta = 60°$

12. If x, y, z are not equal and ≠ 0, ≠ 1 the value of $\begin{vmatrix} \log x & \log y & \log z \\ \log 2x & \log 2y & \log 2z \\ \log 3x & \log 3y & \log 3z \end{vmatrix}$ is equal to

(1) log (6 x y z) (2) log (x + y + z) (3) log (x y z) (4) 0

Ans (4)

$$\begin{vmatrix} \log x & \log y & \log z \\ \log 2x & \log 2y & \log 2z \\ \log 3x & \log 3y & \log 3z \end{vmatrix}$$

$$= \begin{vmatrix} \log x & \log y & \log z \\ \log 2 + \log x & \log 2 + \log y & \log 2 + \log z \\ \log 3 + \log x & \log 3 + \log y & \log 3 + \log z \end{vmatrix}$$

Applying $R_2 \to R_2 - R_1$ and $R_3 \to R_3 - R_1$

$$= \begin{vmatrix} \log x & \log y & \log z \\ \log 2 & \log 2 & \log 2 \\ \log 3 & \log 3 & \log 3 \end{vmatrix}$$

$= 0$

13. If $\vec{a}$ and $\vec{b}$ are unit vectors then what is the angle between $\vec{a}$ and $\vec{b}$ for $\sqrt{3}\,\vec{a} - \vec{b}$ to be unit vector?

(1) 45° (2) 90° (2) 30° (4) 60°

Ans (3)

$\left|\sqrt{3}\,\vec{a} - \vec{b}\right| = 1$

$\Rightarrow \left|\sqrt{3}\vec{a} - \vec{b}\right|^2 - 1$

$\Rightarrow \left(\sqrt{3}\vec{a} - \vec{b}\right)\cdot\left(\sqrt{3}\vec{a} - \vec{b}\right) = 1$

$$\Rightarrow 3|\vec{a}|^2 = \sqrt{3}(\vec{a}\cdot\vec{b}) - \sqrt{3}(\vec{b}\cdot\vec{a}) + |\vec{b}|^2 = 1$$

$$\Rightarrow 3 - 2\sqrt{3}\left[|\vec{a}|\ |\vec{b}|\cos\theta\right] + 1 = 1$$

$$\Rightarrow 3 = 2\sqrt{3}\cos\theta$$

$$\Rightarrow \cos\theta = \frac{\sqrt{3}}{2}\ \ \theta = 30°$$

14. If A is any square matrix of order 3 × 3 then | 3A | is equal to

(A) $\frac{1}{3}|A|$ (2) 9 | A | (3) 3 | A | (4) 27 | A |

Ans (4)

$| 3A | = 3^3 | A | = 27 | A |$

15. The simplified form of $\tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right)$ is equal to

(1) $\frac{\pi}{4}$ (2) π (3) 0 (4) $\frac{\pi}{2}$

Ans (1)

$$GE = \tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left(\frac{x-y}{x+y}\right)$$

$$= \tan^{-1}\left(\frac{x}{y}\right) - \tan^{-1}\left[\frac{1-\frac{y}{x}}{1+\frac{y}{x}}\right]$$

$$= \tan^{-1}\frac{x}{y} - \tan^{-1}1 + \tan^{-1}\frac{y}{x}$$

$$= \tan^{-1}\frac{x}{y} - \frac{\pi}{4} + \cos^{-1}\frac{x}{y}$$

$$= \frac{\pi}{2} - \frac{\pi}{4} = \frac{\pi}{4}$$

16. The set A has 4 elements and the Set B has 5 elements then the number of injective mappings that can be defined from A to B is

(1) 72 (2) 120 (3) 144 (4) 60

Ans (2)

Number of injective mappings = ${}^{n}P_{m} = {}^{5}P_{4} = 120$

17. The 11th term in the expansion of $\left(x + \frac{1}{\sqrt{x}}\right)^{14}$ is

(1) $\frac{1001}{x}$ (2) $\frac{x}{1001}$ (3) $\frac{999}{x}$ (4) i

Ans (1)

$$T_{11} = {}^{14}C_{10}$$

$$x^4 \cdot \frac{1}{x^5} = \frac{{}^{14}C_4}{x} = \frac{1001}{x}$$

18. If $\tan^{-1}\left(x^2+y^2\right)=\alpha$ then $\dfrac{dy}{dx}$ is equal to

(1) xy (2) – xy (3) $\dfrac{-x}{y}$ (4) $\dfrac{x}{y}$

Ans (3)

$\tan^{-1}(x^2 + y^2) = \alpha$

$\Rightarrow x^2 + y^2 = \tan\alpha$

Differentiating w.r.t. x, we get $2x+2y\dfrac{dy}{dx}=0$

$\Rightarrow \dfrac{dy}{dx}=\dfrac{-x}{y}$

19. The solution for the differential equation $\dfrac{dy}{y}+\dfrac{dx}{x}=0$ is

(1) $\log x \cdot \log y = c$ (2) $x + y = c$ (3) $\dfrac{1}{y}+\dfrac{1}{x}=c$ (4) $xy = c$

Ans (4)

$\dfrac{dy}{y}+\dfrac{dx}{x}=0$

$\Rightarrow \log y + \log x = \log c$

$\Rightarrow xy = c$

20. The equation of the normal to the curve $y(1 + x^2) = 2 - x$ where the tangent crosses x-axis is

(1) $x - 5y - 10 = 0$ (2) $x + 5y + 10 = 0$ (3) $5x - y - 10 = 0$ (4) $5x + y + 10 = 0$

Ans

Question not clear

21. The function f(x) = [x] the greatest integer function is continuous at

(1) 4 (2) – 2 (3) 1.5 (4) 1

Ans (3)

22. If $y=e^{\sin^{-1}(t^2-1)}$ and $x=e^{\sec^{-1}\left(\frac{1}{t^2-1}\right)}$ then $\dfrac{dy}{dx}$ is equal to

(1) $\dfrac{-y}{x}$ (2) $\dfrac{-x}{y}$ (3) $\dfrac{x}{y}$ (4) $\dfrac{y}{x}$

Ans (1)

$xy=e^{\frac{\pi}{2}} \Rightarrow x\dfrac{dy}{dx}+y=0 \qquad \therefore \dfrac{dy}{dx}=\dfrac{-y}{x}$

23. If $\sin^{-1}x+\sin^{-1}y=\dfrac{\pi}{2}$, then x^2 is equal to

(1) y^2 (2) $\sqrt{1-y}$ (3) $1 - y^2$ (4) 0

Ans (3)

$\sin^{-1}x+\sin^{-1}y=\dfrac{\pi}{2}$

$\Rightarrow x^2+y^2=1 \Rightarrow x^2=1-y^2$

24. If $A=\frac{1}{\pi}\begin{bmatrix}\sin^{-1}(\pi x) & \tan^{-1}\left(\frac{x}{\pi}\right)\\ \sin^{-1}\left(\frac{x}{\pi}\right) & \cos^{-1}(\pi x)\end{bmatrix}$, $B=\frac{1}{\pi}\begin{bmatrix}-\cos^{-1}(\pi x) & \tan^{-1}\left(\frac{x}{\pi}\right)\\ \sin^{-1}\left(\frac{x}{\pi}\right) & -\tan^{-1}(\pi x)\end{bmatrix}$ then A – B is equal to

(1) 0 (2) $\frac{1}{2}I$ (3) I (4) 2I

Ans (2)

$$A-B=\frac{1}{\pi}\begin{bmatrix}\sin^{-1}\pi x+\cos^{-1}\pi x & 0\\ 0 & \cot^{-1}\pi x+\tan^{-1}\pi x\end{bmatrix}$$

$$=\begin{bmatrix}\frac{1}{2} & 0\\ 0 & \frac{1}{2}\end{bmatrix}=\frac{1}{2}I$$

25. The sum of 1st n terms of the series $\frac{1^2}{1}+\frac{1^2+2^2}{1+2}+\frac{1^2+2^2+3^2}{1+2+3}+\ldots$

(1) $\frac{n(n+2)}{3}$ (2) $\frac{n(n-2)}{6}$ (3) $\frac{n+2}{3}$ (4) $\frac{n(n-2)}{3}$

Ans (1)

$$t_n=\frac{\frac{n(n+1)(2n+1)}{6}}{\frac{n(n+1)}{2}}=\frac{2n+1}{3}$$

$$S_n=\sum t_n=\frac{2}{3}\sum n+\frac{1}{3}\sum 1$$

$$=\frac{2}{3}\times\frac{n(n+1)}{2}+\frac{1}{3}n$$

$$=\frac{n}{3}(n+2)$$

26. The general solution of cot θ + tan θ = 2 is

(1) $\frac{n\pi}{2}+(-1)^n\frac{\pi}{4}$ (2) $\theta=n\pi+(-1)^n\frac{\pi}{8}$ (3) $\theta=\frac{n\pi}{2}+(-1)^n\frac{\pi}{8}$ (4) $\theta=\frac{n\pi}{2}+(-1)^n\frac{\pi}{6}$

Ans (1)

$$\frac{\cos\theta}{\sin\theta}+\frac{\sin\theta}{\cos\theta}=2$$

2sin θ cos θ = 1

sin 2θ = 1

$$\therefore\quad \theta=\frac{n\pi}{2}+(-1)^n\frac{\pi}{4}$$

27. The real part of $(1 - \cos\theta + i\sin\theta)^{-1}$ is

(1) $\frac{1}{1+\cos\theta}$ (2) $\cot\frac{\theta}{2}$ (3) $\frac{1}{2}$ (4) $\tan\frac{\theta}{2}$

Ans (3)

$$\frac{1}{1-\cos\theta+i\sin\theta}$$

$$\frac{1}{2\sin^2\frac{\theta}{2}+2i\sin\frac{\theta}{2}\cos\frac{\theta}{2}}$$

$$=\frac{1}{2\sin\frac{\theta}{2}\left(\sin\frac{\theta}{2}+i\cos\frac{\theta}{2}\right)} = \frac{\sin\frac{\theta}{2}-i\cos\frac{\theta}{2}}{2\sin\frac{\theta}{2}}$$

Real part $=\frac{1}{2}$

28. The contrapositive of the converse of the statement "If x is a prime number then x is odd" is

(1) If x is not an odd number then x is not a prime number

(2) If x is not a prime number then x is not an odd

(3) If x is not a prime number then x is odd

(4) If x is a prime number then it is not odd

Ans (2)

29. If $x^m y^n = (x + y)^{m+n}$ then $\frac{dy}{dx}$ is equal to

(1) xy (2) $\frac{y}{x}$ (3) $\frac{x+y}{xy}$ (4) 0

Ans (2)

Standard result

$$\frac{dy}{dx}=\frac{y}{x}$$

30. The rate of change of area of a circle with respect to its radius at r = 2 cms is

(1) 2π (2) 4π (3) 4 (4) 2

Ans (2)

Area of circle $A = \pi r^2$

$$\frac{dA}{dr}=2\pi r=2\pi\times 2=4\pi$$

31. If $A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$ then $A^2 - 5A$ is equal to

(1) – I (2) – 7I (3) I (4) 7I

Ans (2)

$$A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$$

$$A^2-5A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}-5\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$$

$$=\begin{bmatrix}9-1 & 3+2\\ -3-2 & -1+4\end{bmatrix}-\begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix}$$

$$=\begin{bmatrix}8 & 5\\ -5 & 3\end{bmatrix}-\begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix}=\begin{bmatrix}-7 & 0\\ 0 & -7\end{bmatrix}=-7I$$

32. If the straight lines 2x + 3y – 3 = 0 and x + ky + 7 = 0 are perpendicular, then the value of k is

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

Ans (4)

$m_1 = \frac{-2}{3}$

$m_2 = \frac{-1}{k}$ $\qquad \frac{-2}{3} \times \frac{-1}{k} = -1$

$k = \frac{-2}{3}$

33. If 3 $\tan^{-1} x + \cot^{-1} x = \pi$ then x equal to

(1) 1 (2) $\frac{1}{2}$ (3) 0 (4) – 1

Ans (1)

$3 \tan^{-1} x + \cot^{-1} x = \pi$

$2\tan^{-1} x + \frac{\pi}{2} = \pi$

$2\tan^{-1} x = \frac{\pi}{2}$

$\tan^{-1} x = \frac{\pi}{4}$

$x = 1$

34. If $P(A \cap B) = \frac{7}{10}$ and $P(B) = \frac{17}{20}$, where P stands for probability then P(A | B) is equal to

(1) $\frac{17}{20}$ (2) $\frac{1}{8}$ (3) $\frac{7}{8}$ (4) $\frac{14}{17}$

Ans (4)

$$P(A | B) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{7}{10}}{\frac{17}{20}} = \frac{14}{17}$$

35. The value of $\int \frac{e^x(1+x)dx}{\cos^2(e^x \cdot x)}$ is equal to

(1) $\tan(e^x \cdot x) + c$ (2) $\cot(e^x) + c$

(3) $-\cot(ex^x) + c$ (4) $\tan(e^x) + c$

Ans (1)

$\int e^x(1+x)\sec^2(e^x x)dx$ $\qquad xe^x = t$

$= \int \sec^2 t \, dt$ $\qquad (xe^x + e^x)\, dx = dt$

$= \tan t + c = \tan(xe^x) + c$ $\qquad e^x(x + 1)\, dx = dt$

36. The value of x if $x\left(\hat{i} + \hat{j} + \hat{k}\right)$ is a unit vector is

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

Ans (3)

$x^2 + x^2 + x^2 = 1$

$3x^2 = 1$

$x^2 = \frac{1}{3}$

$x = \pm\frac{1}{\sqrt{3}}$

37. The length of latus rectum of the parabola $4y^2 + 3x + 3y + 1 = 0$ is

(1) 7 (2) $\frac{3}{4}$ (3) $\frac{4}{3}$ (4) 12

Ans (2)

$4y^2 + 3y = -3x - 1$

$LR = \frac{|\text{coefficient of } x|}{\text{coefficient of } y^2} = \frac{3}{4}$

38. The value of $\tan\frac{\pi}{8}$ is equal to

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

Ans (4)

$\tan\frac{\pi}{8} = \sqrt{2}-1 = \frac{1}{\sqrt{2}+1}$

39. The value of $\int \frac{e^x(x^2\tan^{-1}x + \tan^{-1}x + 1)}{x^2+1}dx$ is equal to

(1) $\tan^{-1}(e^x) + c$ (2) $e^{\tan^{-1}x} + c$ (3) $e^x \tan^{-1}x + c$ (4) $\tan^{-1}(x^c) + c$

Ans (3)

$\int e^x \cdot \left\{\frac{(1+x^2)\cdot\tan^{-1}x + 1}{(x^2+1)}\right\}dx$

$= \int e^x\left\{\tan^{-1}x + \frac{1}{x^2+1}\right\}dx$

$= e^x \cdot \tan^{-1}x + c$

40. Integrating factor of $x\frac{dy}{dx} - y = x^4 - 3x$ is

(1) log x (2) $-x$ (3) x (4) $\frac{1}{x}$

Ans (4)

$\frac{dy}{dx} - \frac{y}{x} = x^3 - 3$

If $e^{\int Pdx} = e^{-\int\frac{1}{x}dx} = e^{-\log x} = e^{\log x^{-1}} = \frac{1}{x}$

41. Area lying between the curves $y^2 = 2x$ and $y = x$ is

(1) $\frac{1}{3}$sq.units (2) $\frac{3}{4}$sq.units (3) $\frac{2}{3}$sq.units (4) $\frac{1}{4}$sq.units

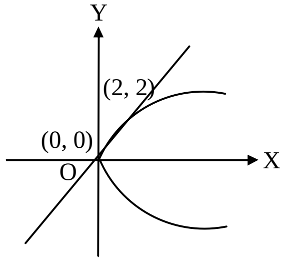
Ans (3)

$y^2 = 2x$ and $y = x$

$\Rightarrow x^2 = 2x$

$\Rightarrow x = 0 \quad x = 2$

$\Rightarrow y = 0 \quad y = 2$



$$A = \int_0^2 \left(\sqrt{2x} - x\right) dx$$

$$= \sqrt{2}\left.\frac{x^{3/2}}{\frac{3}{2}}\right]_0^2 - \left.\frac{x^2}{2}\right]_0^2$$

$$= \frac{\left(2\sqrt{2}\right)\left(2\sqrt{2}\right)}{3} - 2 = \frac{2}{3}$$

42. Let f : R $\rightarrow$ R be defined by f(x) = 2x + 6 which is bijective mapping then f^{-1} (x) is given by

(1) 2x + 6 (2) 6x + 2 (3) $\frac{x}{2} - 3$ (4) x – 3

Ans (3)

$f^{-1}(y) = x \Rightarrow f(x) = g \Rightarrow 2x + 6 = y \Rightarrow x = \frac{y-6}{2}$

$f^{-1}(y) = \frac{y-6}{2}$

$f^{-1}(x) = \frac{x}{2} - 3$

43. Suppose $\vec{a} + \vec{b} + \vec{c} = 0, |\vec{a}| = 3, |\vec{b}| = 5, |\vec{c}| = 7$, then the angle between $\vec{a}$ and $\vec{b}$ is

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{4}$ (3) π (4) $\frac{\pi}{3}$

Ans (4)

$\vec{a} + \vec{b} = -\vec{c}$

$a^2 + b^2 + 2\vec{a} \cdot \vec{b} = c^2$

$9 + 25 + 2ab \cos \theta = 49$

$2(3)(5) \cos \theta = 15$

$\Rightarrow \cos\theta = \frac{1}{2}$

$\Rightarrow \theta = \frac{\pi}{3}$

44. If x = 2 + 3 cos θ and y = 1 – 3 sin θ represent a circle then the centre and radius is

(1) (2, 1), 3 (2) (–2, –1), 3 (3) (2, 1), 9 (4) $(1, 2), \frac{1}{3}$

Ans (1)

$(x - 2)^2 = 9 \cos^2 \theta$ and $(y - 1)^2 = 9 \sin^2 \theta$

$\Rightarrow (x - 2)^2 + (y - 1)^2 = 9$

Centre (2, 1) and r = 3

45. The vector equation of the plane which is at a distance of $\frac{3}{\sqrt{14}}$ from the origin and the normal from the origin is $2\hat{i}-3\hat{j}+\hat{k}$ is

(1) $\vec{r}\cdot(\hat{i}+\hat{j}+\hat{k})=9$ (2) $\vec{r}\cdot(2\hat{i}+\hat{k})=3$ (3) $\vec{r}\cdot(2\hat{i}-3\hat{j}+\hat{k})=3$ (4) $\vec{r}\cdot(\hat{i}+2\hat{j})=3$

Ans (3)

$\vec{r}\cdot\vec{n}=p$

$\vec{r}\cdot\frac{\left(2\hat{i}-2\hat{j}+\hat{k}\right)}{\sqrt{4+9+1}}=\frac{3}{\sqrt{14}}$

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

46. If a = 3, b = 4, c = 5 each one of $\vec{a}$, $\vec{b}$ and $\vec{c}$ is perpendicular to the sum of the remaining then $|\vec{a}+\vec{b}+\vec{c}|$ is equal to

(1) $\frac{2}{\sqrt{5}}$ (2) $\sqrt{5}$ (3) $\frac{5}{\sqrt{2}}$ (4) $5\sqrt{2}$

Ans (4)

Given :

$$\left.\begin{array}{ll}\vec{a}\cdot\left(\vec{b}+\vec{c}\right)=0 & ...(1)\\ \vec{b}\cdot\left(\vec{c}+\vec{a}\right)=0 & ...(2)\\ \vec{c}\cdot\left(\vec{a}+\vec{c}\right)=0 & ...(3)\end{array}\right\}\Rightarrow 2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right)=0$$

(1) + (2) + (3)

$\left|\vec{a}+\vec{b}+\vec{c}\right|^2=\left|\vec{a}\right|^2+\left|\vec{b}\right|^2+\left|\vec{c}\right|^2+2\left(\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}\right)$

$\left|\vec{a}+\vec{b}+\vec{c}\right|^2=9+16+25+0$

$\therefore\quad \left|\vec{a}+\vec{b}+\vec{c}\right|=5\sqrt{2}$

47. The value of $\int\frac{e^{6\log x}-e^{5\log x}}{e^{4\log x}-e^{3\log x}}dx$ is equal to

(1) $\frac{x^3}{3}$ (2) $\frac{1}{x}$ (3) 0 (4) $\frac{3}{x^3}$

Ans (1)

$\int\frac{x^6-x^5}{x^4-x^3}dx=\int\frac{x^5(x-1)}{x^3(x-1)}dx=\int x^2\,dx=\frac{x^3}{3}$

48. Two dice are thrown simultaneously, the probability of obtaining a total score of 5 is

(1) $\frac{1}{12}$ (2) $\frac{1}{6}$ (3) $\frac{1}{18}$ (4) $\frac{1}{9}$

Ans (4)

n(S) = 36

Favourable outcomes : (1, 4), (4, 1), (3, 2), (2, 3)

Required probability $\frac{4}{36}=\frac{1}{9}$

49. The value of $\int_2^8 \frac{\sqrt{10-x}}{\sqrt{x}+\sqrt{10-x}}dx$ is

(1) 0 (2) 3 (3) 10 (4) 8

Ans (2)

Let $I = \int_2^8 \frac{\sqrt{10-x}}{\sqrt{x}+\sqrt{10-x}} dx$ … (1)

$I = \int_2^8 \frac{\sqrt{10-(10-x)}}{\sqrt{10-x}+\sqrt{10-(10-x)}}dx$

$I = \int_2^8 \frac{\sqrt{x}}{\sqrt{10-x}\sqrt{x}}$ … (2)

(1) + (2) $\Rightarrow$ $2I = \int_2^8 1\, dx = x]_2^8 = 6$

2I = 6 $\Rightarrow$ I = 3

50. If $x^y = e^{x-y}$ then $\frac{dy}{dx}$ is equal to

(1) $\frac{e^x}{x^{x-y}}$ (2) $\frac{1}{y}-\frac{1}{x-y}$ (3) $\frac{\log x}{\log(x-y)}$ (4) $\frac{\log x}{(1+\log x)^2}$

Ans (4)

$x^y = e^{x-y}$

$\Rightarrow \log x^y = \log e^{x-y}$

$\Rightarrow y \log x = x - y \Rightarrow y = \frac{x}{1+\log x}$

$\Rightarrow y \cdot \frac{1}{x} + \log x \frac{dy}{dx} = 1 - \frac{dy}{dx}$

$\frac{dy}{dx} = \frac{(1+\log x)1 - x \cdot \frac{1}{x}}{(1+\log x)^2}$

$= \frac{\log x}{(1+\log x)^2}$

51. Find the co-ordinates of the foot of the perpendicular drawn from the origin to the plane 5y + 8 = 0

(1) $\left(0, \frac{8}{5}, 0\right)$ (2) $\left(0, -\frac{8}{5}, 0\right)$ (3) $\left(0, -\frac{18}{5}, 2\right)$ (4) $\left(\frac{8}{25}, 0, 0\right)$

Ans (2)

By inspection, $\left(0, -\frac{8}{5}, 0\right)$ lies on the plane 5y + 8 = 0

$\therefore\ 5\left(-\frac{8}{5}\right) + 8 = 0$

$\therefore\ \left(0, -\frac{8}{5}, 0\right)$ are the coordinates of the foot of the perpendicular from the origin to the plane 5y + 8 = 0

52. If 1 + sin θ + $\sin^2$ θ + … upto $\infty = 2\sqrt{3}+4$, then θ = ______

(1) $\frac{\pi}{4}$ (2) $\frac{3\pi}{4}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

Ans (4)

$$2\sqrt{3}+4=\frac{1}{1-\sin\theta}$$

$$\therefore\quad 1-\sin\theta=\frac{1}{2\sqrt{3}+4}=\frac{2\sqrt{3}-4}{12-16}=\frac{2\sqrt{3}-4}{-4}=-\frac{\sqrt{3}}{2}+1$$

$$\sin\theta=\frac{\sqrt{3}}{2}\Rightarrow\theta=\frac{\pi}{3}$$

53. The simplified form of $i^n + i^{n+1} + i^{n+2} + i^{n+3}$ is

(1) 1 (2) i (3) 0 (4) –1

Ans (3)

$$i^n\left(1+i-1-i\right)=0$$

54. If A is a matrix of order m × n and B is a matrix such that AB′ and B′A are both defined, the order of the matrix B is

(1) n × n (2) m × n (3) m × m (4) n × m

Ans (2)

$$A=m\times n,\ B=p\times v$$

$$AB'=\left(m\times n\right)\cdot\left(q\times p\right)\Rightarrow q=n$$

$$B'A=\left(q\times p\right)\cdot\left(m\times n\right)\Rightarrow p=m$$

55. The slope of the tangent to the curve x = t^2 + 3t – 8, y = $2t^2$ – 2t – 5 at the point (2, –1) is

(1) $\frac{6}{7}$ (2) $\frac{-6}{7}$ (3) $\frac{22}{7}$ (4) $\frac{7}{6}$

Ans (1)

$t^2+3t-8=2$

$t^2+3t-10=0$

$\left(t+5\right)\left(t-2\right)=0$

$t-5,\quad t=-2$

y = –1

$2t^2 - 2t - 5 = -1$

$2t^2 - 2t - 4 = 0$

$t^2 - t - 2 = 0$

(t – 2) (t + 1) = 0

t = 2, t = –1

∴ t = 2

$$\frac{dy}{dx}=\frac{4t-2}{2t+3}$$

at t = 2, $\frac{dy}{dx}=\frac{8-2}{4+3}=\frac{6}{7}$

56. The coefficient of variation of two distributions are 60 and 70. The standard deviation are 21 and 16 respectively, then their mean is

(1) 23 (2) 22.85 (3) 35 (4) 28.25

Ans

Question not clear

57. The value of $\sin^{-1}\left(\cos\frac{53\pi}{5}\right)$ is

(1) $\frac{-3\pi}{5}$ (2) $\frac{-\pi}{10}$ (3) $\frac{3\pi}{5}$ (4) $\frac{\pi}{10}$

Ans (2)

$$\cos\left(\frac{53\pi}{5}\right)=\cos\left(10\pi+\frac{3\pi}{5}\right)=\cos\frac{3\pi}{5}=\cos\left(\pi-\frac{2\pi}{5}\right)=-\cos\frac{2\pi}{5}$$

$$=-\sin\left(\frac{\pi}{2}-\frac{2\pi}{5}\right)=-\sin\frac{\pi}{10}$$

$$\sin^{-1}\left(-\sin\frac{\pi}{10}\right)=-\frac{\pi}{10}$$

58. The order and degree of the differential equation $\left[1+\left(\frac{dy}{dx}\right)^2+\sin\left(\frac{dy}{dx}\right)\right]^{3/4}=\frac{d^2y}{dx^2}$

(1) order = 2, degree = 4 (2) order = 2, degree = not defined

(3) order = 2, degree = 3 (4) order = 2, degree = $\frac{3}{4}$

Ans (2)

$$\left[1+\left(\frac{dy}{dx}\right)^2+\sin\left(\frac{dy}{dx}\right)\right]^3=\left(\frac{d^2y}{dx^2}\right)^4$$

$\therefore$ order = 2, degree not defined.

59. The value of the sin 1° + sin 2° + … + sin 359° is equal to

(1) 1 (2) 180 (3) 0 (4) –1

Ans (3)

G.E. (sin 1° + sin 359°) + (sin 2° + sin 358°) + ….

= 0 + 0 + … + 0 = 0

60. $\int_0^{\frac{\pi}{2}}\frac{\sin^{1000}x dx}{\sin^{1000}x+\cos^{1000}x}$ is equal to

(1) 1 (2) $\frac{\pi}{4}$ (3) 1000 (4) $\frac{\pi}{2}$

Ans (2)

$$I=\int_0^{\frac{\pi}{2}}\frac{\sin^{1000}x\,dx}{\sin^{1000}x+\cos^{1000}x} \quad \ldots (1)$$

$$I=\int_0^{\frac{\pi}{2}}\frac{\cos^{1000}x\,dx}{\cos^{1000}x+\sin^{1000}x} \quad \ldots (2)$$

(1) + (2) gives

$$2I=\int_0^{\frac{\pi}{2}}1dx=x\Big|_0^{\frac{\pi}{2}}$$

$$=\frac{\pi}{2}\quad \therefore I=\frac{\pi}{4}$$

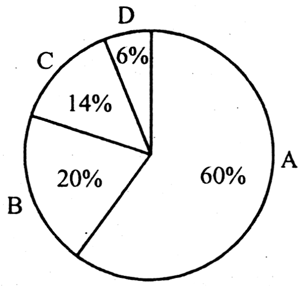
KARNATAKA COMMON ENTRANCE TEST
MAY, 2016
BIOLOGY - KEYS
Test Paper Code : B-2

1. Identify from the following group of animals, which exhibit oestrous cycle.
   (1) Monkey, ape, man and elephant
   (2) Lion, deer, dog and cow
   (3) Lion, dog, monkey and ape
   (4) Cow, monkey, elephant and ape
   Ans (2)

2. The codons UUU and UUC codes for phenylalanine only. This feature of genetic code is called
   (1) degenerate (2) commaless
   (3) non-ambiguous (4) non-overlapping
   Ans (1)

3. Connel's field experiment on the rocky sea coast of Scotland, where larger Barnacle balanus dominates the intertidal area and removes the smaller Barnacle cathamalus. This happened due to
   (1) Parasitism (2) Predation
   (3) Mutualism (4) Competition
   Ans (4)

4. The relative contribution of various green house gases to total global warming is given in the following diagram:



   Identify the green house gases.
   (1) A = CFCs ; B = CO_2 ; C = CH_4 ; D = N_2O (2) A = CO_2 ; B = CH_4 ; C = CFCs ; D = N_2O
   (3) A = CFCs ; B = CH_4 ; C = CO_2 ; D = N_2O (4) A = CO_2 ; B = CFCs ; C = CH_4 ; D = N_2O
   Ans (2)

5. Which among these is not a post fertilization event'?
   (1) Fruit formation (2) Gametogenesis (3) Seed formation (4) Embryogenesis
   Ans (2)

6. Facultative absorption of water from primary urine is influenced by the hormone
   (A) Vasopressin (2) Androgens (3) Thyroxine (4) Epinephrine
   Ans (1)

7. Digestion of proteins is incomplete in the absence of enterokinase, because
   (1) Trypsinogen is not converted into trypsin
   (2) Pepsinogen is not converted into pepsin
   (3) Prorennin is not converted into rennin
   (4) Chymotrypsinogen is not converted into chymotrypsin
   Ans (1)

8. The puffed-up appearance of dough is due to fermentation by bacteria. Identify the gas liberated during the process.
   (1) Hydrogen sulphide (2) Methane (3) Ammonia (4) Carbon dioxide
   Ans (4)

9. All the following interactions are mutualism, except
   (1) plant and animal relation for pollination
   (2) association of algae and fungi in lichens
   (3) association of cattle egret and grazing cattle
   (4) association of fungi and roots of higher plants in mycorrhiza
   Ans (3)

10. Identify the incorrect statement from the following.
    (1) Response of T-cells is called cell mediated immunity
    (2) B-cells produce antibody
    (3) Macrophages are the phagocytic cells
    (4) Interferons kill viruses
    Ans (4)

11. Elution means
    (1) making the DNA bands visible under UV radiation
    (2) separation of DNA fragments on agarose gel
    (3) isolating alien DNA from the choice organism
    (4) cutting and extraction of DNA bands from the agarose gel
    Ans (4)

12. Choose the correct sequence of events occur in human reproduction.
    (A) Gametogenesis → insemination → fertilization → implantation → gestation → parturition
    (2) Gametogenesis → gestation → insemination → fertilization → implantation → parturition
    (3) Gestation → gametogenesis → insemination implantation → fertilization → parturition
    (4) Gametogenesis → insemination →gestation → implantation → fertilization → parturition
    Ans (1)

13. What is the role of competitive inhibitor during enzyme action?
    (1) It alters the active site of the enzyme and prevents the binding of substrate
    (2) It enhances enzyme action
    (3) It inhibits breaking of chemical bonds of the substrate
    (4) It declines the enzyme action
    Ans (4)

14. In which type of interactions, both the interacting organisms do not live close together?

(1) Mutualism (2) Predation (3) Competition (4) Parasitism

Ans (3)

15. Plants obtained through tissue culture are genetically identical and they are obtained by somatic cells. What do you call them?

(1) Somatic hybrids (2) Somaclones (3) Cross hybrids (4) Monoclones

Ans (2)

16. A plant is provided with ideal conditions for photosynthesis and supplied with isotope $^{14}CO_2$. When the products of the process are analysed carefully, what would be the nature of products?

(1) Both glucose and oxygen are normal

(2) Both glucose and oxygen are labelled

(3) Only glucose is labelled and oxygen is normal

(4) Only oxygen is labelled but glucose is normal

Ans (3)

17. Sarcomere is the functional unit of contraction in a muscle fibre. Identify the portion of myofibril that constitute a sarcomere.

(1) The portion of myofibril between two successive ‘A’ band

(2) The portion of myofibril between two successive ‘Z’ line

(3) The portion of myofibril between two successive ‘M’ line

(4) The portion of myofibril between two successive ‘I’ band

Ans (2)

18. Snow blindness is caused due to

(1) Acid rain (2) Ozone hole (3) Green house effect (4) Nuclear winter

Ans (2)

19. In a polysaccharide, number of monosaccharides are linked by

(1) glycosidic bond (2) peptide bond (3) hydrogen bond (4) phosphoester bond

Ans (1)

20. Which one of these is not an accessory glands in male reproductive system?

(1) Cowper’s gland (2) Prostate gland

(3) Bartholin’s gland (4) Seminal vesicle

Ans (3)

21. In a dithecous anther, each pollen sac contain 1000 MMC. What is the total number of pollen-grains produced by the anther?

(1) 16,000 (2) 4,000 (3) 32,000 (4) 8,000

Ans (1)

22. Choose the incorrect statement from the following.

(1) Adipose tissue is a type of dense connective tissue

(2) Tendons attach muscle to bone

(3) Cartilage is made up of chondrocytes

(4) Ciliated epithelium is the modified columnar epithelium

Ans (1)

23. What is the function of the enzyme ‘recombinase’ during meiosis?
(1) Condensation of chromosomes
(2) Formation of synaptonemal complex
(3) Alignment of bivalent chromosomes on equatorial plate
(4) Crossing over between non-sister chromatids
Ans (4)

24. A person admitted to hospital as he had myocardial infarction. A cardiologist injecting him ‘streptokinase’, why?
(1) It stimulates heart beat
(2) It reduces hypertension
(3) It acts as clot buster
(4) It reduces the level of blood cholesterol
Ans (3)

25. One of the following area is an example for secondary succession, if the succession takes place in/on
(1) newly created pond
(2) abandoned farm land
(3) bare rock
(4) newly cooled lava
Ans (2)

26. Desired genes have been introduced into transgenic animals to obtain large scale production of useful biological products encoded by these genes. This approach is generally referred to as
(1) gene therapy
(2) hybridoma technology
(3) down stream processing
(4) molecular farming
Ans (4)

27. The edible part of the fruit of apple is
(1) Endocarp
(2) Thalamus
(3) Involucre
(4) Pericarp
Ans (2)

28. Lactational amenorrhea
(1) prevents secretion of prolactin
(2) prevents secretion of milk from breast
(3) prevents spermatogenesis
(4) prevents conception
Ans (4)

29. The gene for haemophilia is located on ‘X’ chromosome. Hence it is normally impossible for a
(1) carrier mother to pass the gene to her son
(2) haemophilic father to pass the gene to his daughter
(3) haemophilic father to pass the gene to his son
(4) carrier mother to pass the gene to her daughter
Ans (3)

30. The primary treatment of sewage water involves
(1) anaerobic bacterial activity
(2) sludge digestion
(3) filtration and sedimentation
(4) aerobic bacterial activity
Ans (3)

31. Which one of the following statements is not correct about a plasmid?
(1) It has the ability of autonomous replication
(2) It is a circular DNA
(3) It's DNA is as long as chromosomal DNA
(4) It has antibiotic resistant gene
Ans (3)

32. A scrubber in the exhaust of a chemical industry removes
(1) nitrous oxide (2) hydrogen sulphide
(3) carbon monoxide (4) sulphur dioxide
Ans (4)

33. A doctor identifies symptoms of nasal congestion, headache, sore throat, hoarseness, cough in a patient. The conclusion is that, the patient is infected by a pathogen
(1) Plasmodium (2) Adeno virus (3) Salmonella (4) Rhino virus
Ans (4)

34. Most suitable method of introducing alien DNA into a plant cell is
(1) lipofection (2) biolistics (3) heat shock method (4) microinjection
Ans (2)

35. Some of the events occur during life cycle of plasmodium are given below. Identify the correct statement.
(1) Female mosquito take up sporozoites with blood meal
(2) The sporozoites reproduce sexually in liver cells
(3) When mosquito bites a man, gametocytes are injected
(4) The gametocytes develop in RBC
Ans (4)

36. The phenomenon called 'Apical dominance' in plants is due to a phytohormone
(1) Cytokinins (2) Auxins
(3) ABA (4) Gibberellins
Ans (2)

37. Match the plant structures given in the column-I with their plants given in the column-TI.

Column I		**Column II**	
A.	Prothallus	p.	Bryophytes
B.	Microsporophyll	q.	Pteridophytes
C.	Protonema	r.	Angiosperms
D.	PEN	s.	Gymnosperms

(1) A - q, B - s, C - r, D - p (2) A - r, B - p, C - s, D - q
(3) A - q, B - s, C - p, D - r (4) A - s, B - r, C – p, D - q
Ans (3)

38. Pick the hormone which is not secreted by human placenta.

(1) Prolactin (2) hCG (3) Estrogen (4) hPL

Ans (1)

39. The gene disorder phenylketonuria is an example for

(1) Multiple allelism (2) Polygenic inhentance

(3) Multiple factor (4) Pleiotropy

Ans (4)

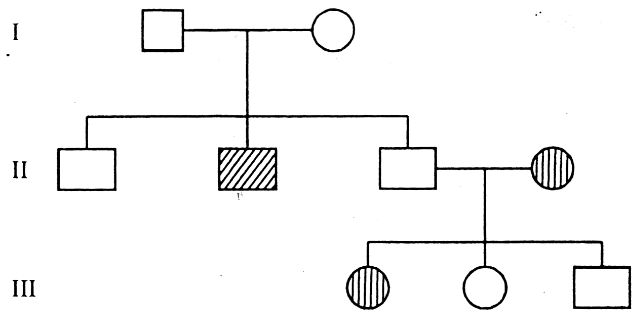
40. 'A' and 'B' are the two adjacent living cells. The cell 'A' has solute potential (ψ_s) of – 9 bars and pressure potential (ψ_p) of 4 bars, whereas cell 'B' has solute potential (ψ_s) of – 8 bars and pressure potential (ψ_p) of 5 bars. What will be the direction of water movement between these cells?

(1) Do not move in any direction (2) Cell A to Cell B

(3) Moves in both the directions (4) Cell B to Cell A

Ans (4)

41. From the following pedigree chart of a family, one can make an analysis that,



(1) It is an allosomal dominant trait (2) It is an autosomal dominant trait

(3) It is an allosomal recessive trait (4) It is an autosomal recessive trait

Ans (4)

42. Find the mis-match from the following pairs:

(1) Natural selection → Industrial melanism

(2) Divergent evolution → thorn of bougainvillia and tendril of cucurbita

(3) Genetic drift → Constant gene frequency

(4) Adaptive radiation → Australian marsupials

Ans (3)

43. The hormone 'melatonin' is secreted by the gland

(1) Pineal (2) Thyroid (3) Pituitary (4) Adrenal

Ans (1)

44. Which one of the following statement is correct?

(1) Chasmogamous flowers never exhibits autogamy

(2) Chasmogamous flowers always exhibits geitonogamy

(3) Cleistogamous flowers exhibits both autogamy and geitonogamy

(4) Cleistogamous flowers always exhibits autogamy

Ans (4)

45. In plants, lateral roots arise from

(1) endodermis (2) epidermis (3) pericycle (4) hypodermis

Ans (3)

46. Identify a micro-organism that can produces biomass of protein.

(1) *Methylophilus methylotrophus* (2) *Monoscus purpureus*

(3) *Trichoderma polysporum* (4) *Aspergillus niger*

Ans (1)

47. Identify the correct equation for Hardy-Weinberg law.

(A) $(p + q)^2 = 1$ (2) $p + q = 1$ (3) $(p - q)^2 = 1$ (4) $p - q = 1$

Ans (1)

48. A population is correctly defined as having which of the following characteristics?

a. Inhabiting the same geography area

b. Individuals belonging to same species

c. Possessing a constant and uniform density and dispersion

(1) a and c only (2) a and b only (3) b only (4) b and c only

Ans (2)

49. Offsprings formed during sexual reproduction exhibits more variation than, those formed asexual method, because,

(1) sexual reproduction is more complicated

(2) genetic material comes from two different individuals

(3) genetic material comes from male parent

(4) greater amount of DNA is involved

Ans (2)

50. Read the following statements carefully and choose the correct statements:

a. In a transcription unit, the promoter located at the $5'$ end of coding strand.

b. The single strand DNA having the polarity $5' \rightarrow 3'$ is the template strand.

c. RNA polymerase binds to the operator during transcription.

d. Single base DNA differences occur in humans are called Single Nucleotide Polymorphism (SNPs).

(1) Statements b and d (2) Statements a and b

(3) Statements a and d (4) Statements b and c

Ans (3)

51. In a taxonomic hierarchy, the number of common characters will increase as we go from

(1) Class to Order (2) Species to Kingdom (3) Genus to Species (4) Kingdom to Species

Ans (4)

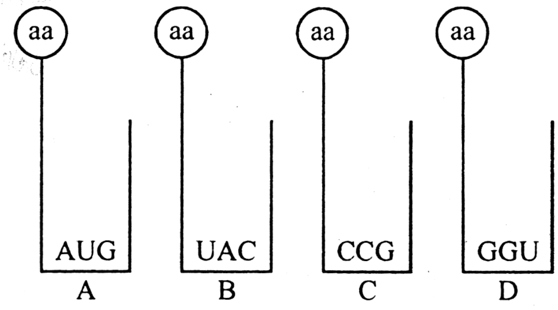
52. A human male is heterozygous for autosomal genes ‘A’ and ‘B’. He is also hemizygous for haemophilic gene ‘h’. What percentage of sperms will carry ‘abh’ genotype?

(1) 75% (2) 25% (3) 0% (4) 50%

Ans (–)

None of the options are matching.

53. Find the sequence of binding of the following aminoacyl t-RNA complexes during translation to m-RNA transcribed by a DNA segment having the base sequences 3′TACATGGGTCCG5′.



Choose the answer showing the correct order of alphabets.

(1) C, D, B, A (2) A, B, D, C (3) D, C, A, B (4) B, A, D, C

Ans (4)

54. Some desert beetles can survive on "metabolic water", without ever drinking liquid water which

(1) is a breakdown product of pyruvate inside the mitochondria, along with carbon dioxide

(2) was produced as water in the organisms they eat

(3) is a breakdown product from glycolysis in the cytoplasm

(4) is absorbed from the air along with respiratory oxygen

Ans (1)

55. Which one of the following statement is wrong with respect to separation of DNA fragments on gel electrophoresis?

(1) The DNA fragments resolve according to their size

(2) The DNA fragments move towards anode under electric field through the matrix

(3) The smaller DNA fragments separate first

(4) The commonly used matrix is agarose gel

Ans (–)

None of the options are matching.

56. E. coli bacteria grew in $^{15}NH_4Cl$ medium for several generations are allowed to grow in $^{14}NH_4Cl$ medium. After 2 generations, the bacteria are isolated from the medium and DNA of bacteria centrifuged in CsCI. The result of the density gradient of DNA is

(1) both heavy and light DNA (2) only hybrid DNA

(3) both hybrid and light DNA (4) both hybrid and heavy DNA

Ans (3)

57. Amniocentesis is one of the methods

(1) for foetal sex determination (2) adapted for MTP

(3) used for safe parturition (4) of birth control

Ans (1)

58. The rate of formation of new organic matter by deer in a forest ecosystem is called

(1) Standing crop (2) Primary productivity

(3) Net Primary productivity (4) Secondary productivity

Ans (4)

59. One of the breeding techniques useful to eliminate harmful recessive genes by selection is

(1) In-breeding

(2) Artificial insemination

(3) MOET

(4) Out-breeding

Ans (1)

60. A person who has allergy, the type of antibody produced in his body is

(1) IgE (2) IgA (3) 1gM (4) IgG

Ans (1)

* * *