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SKD New Standard Coaching Institute
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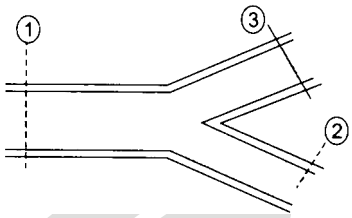
37 YEARS OF TEACHING EXCELLENCE
Ist & IInd Floor, Skylark Building,
Near Leela Cinema, Newal Kishore Road,
Hazratganj, Lucknow. Toll Free-1800-102-0056

SAMPLE PAPER - 3

PHYSICS

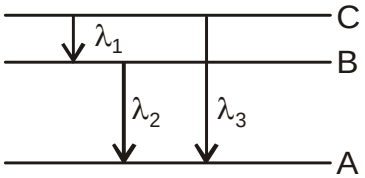
01. A man wishes to cross a river in a boat. If he crosses the river in minimum time he takes 10 minutes with a drift of 120 m. If he crosses the river taking shortest route, he takes 12.5 minutes. Find velocity of the boat with respect to water
(1) 20 m/min (2) 12 m/min
(3) 10 m/min (4) 8 m/min

02. A broad pipe having a radius 10 cm branches into two pipes of radii, 5 cm and 3 cm. If the velocity of flowing water in the pipe of radius 3 cm be 5 cm/s, determine the velocities of water in the remaining two pipes. Given that the rate of discharge through the main branch, is 600 π cm^3/s



(1) v_1 = 6 cm/s and v_2 = 22.2 cm/s
(2) v_1 = 4 cm/s and v_2 = 12.2 cm/s
(3) v_1 = 3 cm/s and v_2 = 12.2 cm/s
(4) None of these

03. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e., $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statements is correct ?



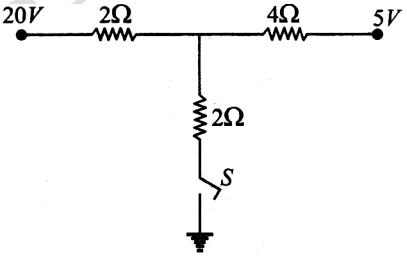
(1) $\lambda_3 = \lambda_1 + \lambda_2$ (2) $\lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}$
(3) $\lambda_1 + \lambda_2 + \lambda_3 = 0$ (4) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

04. An organ pipe open on both ends in the nth harmonic is in resonance with a source of 1000 Hz. The length of pipe is 16.6 cm and speed of sound in air is 332 m/s Find the value of n
(1) 3 (2) 2 (3) 1 (4) 4

05. Two coils have mutual inductance 0.005 H. The current changes in the first coil according to equation $I = I_0 \sin \omega t$, where I_0 = 10 A and $\omega = 100\pi$ rad s^{-1}. The maximum value of emf in volt in the second coil is
(1) 12 π (2) 8 π (3) 5 π (4) 2 π

06. Consider atoms H, He^+, Li^{++} in their ground states. Suppose E_1, E_2 and E_3 are minimum energies required so that the atoms H, He^+, Li^{++} can achieve their first excited states respectively, then
(1) $E_1 = E_2 = E_3$ (2) $E_1 > E_2 > E_3$
(3) $E_1 < E_2 < E_3$ (4) $E_1 = E_2 = E_3$

07. When the switch S is closed in the circuit shown in figure, the current passing through it is:



(1) 7.5 A (2) 3.0 A
(3) 4.5 A (4) 6.5 A

08. The speed given to an object is 20% of escape speed. What is the height reached from surface at which it stops?
(1) $\frac{25R_e}{24}$ (2) $\frac{R_e}{24}$ (3) $\frac{23R_e}{24}$ (4) $\frac{R_e}{25}$

09. A particle moves in xy plane. The position vector at any time t is $\vec{r} = \{(2t)\hat{i} + (2t^2)\hat{j}\}$ m. The rate of change of θ at time t = 2 second (where θ is the angle which its velocity vector makes with positive x-axis) is
(1) $\frac{2}{17}$ rad/s (2) $\frac{1}{14}$ rad/s
(3) $\frac{4}{7}$ rad/s (4) $\frac{6}{5}$ rad/s

10. The potential energy of a particle of mass m is given by

$$U(x) = \begin{cases} E_0 : 0 \le x \le 1 \\ 0; \quad x > 1 \end{cases}$$

λ_1 and λ_2 are the de-Broglie wavelengths of the particle, when $0 \le x \le 1$ and $x > 1$ respectively. If the total energy of particle is $2E_0$, the ratio $\frac{\lambda_1}{\lambda_2}$ will be

(1) 2 (2) 1

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

CHEMISTRY

11. Among the following the weakest base is:
(1) $C_6H_5CH_2NH_2$ (2) $C_6H_5CH_2NHCH_3$
(3) $O_2N–CH_2NH_2$ (4) CH_3NHCHO

12. In Hinsberg test the product of which amine does not dissolve in NaOH?
(1) $CH_3CH_2NH_2$ (2) $(CH_3)_2CHNH_2$
(3) CH_3NHCH_3 (4) $CH_3N(CH_3)_2$

13. Aniline when diazotised in cold and then treated with dimethyl aniline gives a coloured product. Its structure would be:

(1) CH_3NH–C$_6$H$_4$–N=N–C$_6$H$_4$–$NHCH_3$

(2) CH_3–C$_6$H$_4$–N=N–C$_6$H$_4$–NH_2

(3) $(CH_3)_2N$–C$_6$H$_4$–N=N–C$_6$H$_5$

(4) $(CH_3)_2N$–C$_6$H$_4$–NH–C$_6$H$_5$

14. The entropy change for a phase transformation is :

(1) $\frac{\Delta U}{\gamma + dT}$ (2) $\frac{\Delta T}{\Delta U}$

(3) $\frac{\Delta H}{T}$ (4) $\frac{\Delta H + \Delta G}{T}$

15. The enthalpy change for the following reaction is 368 kJ. Calculate the average O – F bond energy.

$$OF_2(g) \longrightarrow O(g) + 2F(g)$$

(1) 184 kJ/mol (2) 368 kJ/mol
(3) 536 kJ/mol (4) 736 kJ/mol

16. Electrode potential data are given below:

$Fe^{3+}_{(aq)} + e^- \longrightarrow Fe^{2+}_{(aq)}$; $E^o = +0.77$ V
$Al^{3+}_{(aq)} + 3e^- \longrightarrow Al_{(s)}$; $E^o = -1.66$ V
$Br_{2(aq)} + 2e^- \longrightarrow 2Br^-_{(aq)}$; $E^o = +1.08$ V

Based on the data given above, reducing power of Fe^{2+}, Al and Br^- will increase in the order:
(1) $Br^- < Fe^{2+} < Al$ (2) $Fe^{2+} < Al < Br^-$
(3) $Al < Br^- < Fe^{2+}$ (4) $Al < Fe^{2+}\ Br^-$

17. Which will form maximum boiling azeotrope ?
(1) $C_6H_6 + C_6H_5CH_3$ solution
(2) $HNO_3 + H_2O$ solution
(3) $C_2H_5OH + H_2O$ solution
(4) n-hexane and n-heptane

18. The correct order of basicities of the following compounds is:

(1) $CH_3–C(=NH)–NH_2$ (2) $CH_3 – CH_2 – NH_2$

(3) $(CH_3)_2NH$ (4) $CH_3 – C(=O) – NH_2$

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

19. Aromatic nitriles (Ar–CN) are not prepared by:
(1) Ar – X + KCN (2) $ArN_2Cl + CuCN$
(3) $ArCONH_2 + P_2O_5$ (4) $ArCONH_2 + SOCl_2$

20. For pure water :
(1) pH increases while pOH decreases with rise in temperature
(2) pH decreases while pOH increases with rise in temperatuer
(3) both pH and pOH decreases with rise in temperature
(4) both pH and pOH increases with rise in temperature

BOTANY

21. Match the columns I and II and choose the correct combination from the options given.

	Column I (Class)		Column II (Major Pigments)
A	Chlorophyceae	i.	Chlorophyll a, c, fucoxanthin
B.	Phaeophyceae	ii.	Chlorophyll a, d, phycoerythrin
C.	Rhodophyceae	iii.	Chlorophyll a, b

(1) A-iii, B-i, C-ii (2) A-iii, B-ii, C-i
(3) A-ii, B-i, C-iii (4) A-i, B-iii, C-ii

22. Which of the following sustance is used in half leaf experiment to absorb CO_2 ?
(1) HCl (2) KOH (3) HNO_4 (4) H_2SO_4

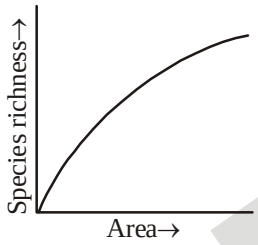
23. The structure that are haploid in Pinus are
(1) Megaspore, embryo and endosperm
(2) Megaspore, pollen grain and endosperm
(3) Leaf, root and embryo
(4) Integument, megaspore and root

24. In moss, meiosis occurs in
(1) Antheridia (2) Archegonia
(3) Capsule (4) Both (1) and (2)

25. "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material." This was a statement of
(1) Wilkins and Franklin
(2) Hershey and Chase
(3) Avery, McLeod, McCarty
(4) Watson and crick

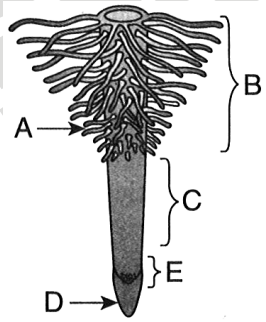
26. Homeostasis is
(1) Tendency of biological system to change with change in environment
(2) Tendency of biological systems to resist change
(3) Disturbance of self-regulatory system and natural controls
(4) Biotic material used in homeopathic medicines

27. Which is the correct formula of the graph shown below? Given:



S-species richness A-Area C-Y-intercept
Z-Slope of line (regression coefficient)
(1) $S = CA^Z$ (2) $S = CZ^A$
(3) $S = ZC^A$ (4) $Z = SC^A$

28. What indicates A to E in the below figure?



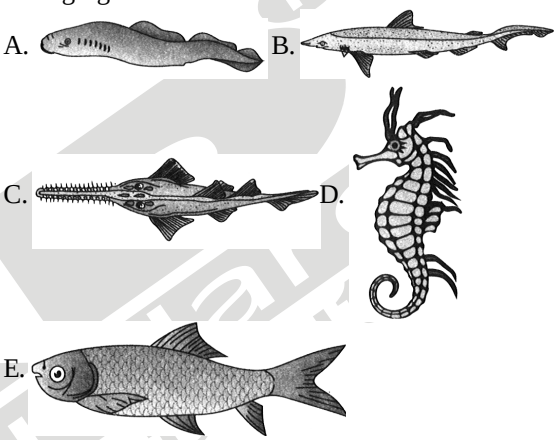
(1) A: Region of maturation, B: Root cap, C: Region of meristematic activity, D: Root hair, E: Region of elongation
(2) A: Root hair, B: Region of maturation, C: Region of elongation, D: Root cap, E: Region of meristematic activity
(3) A: Root cap, B: Region of maturation, C: Region of elongation, D: Root hair, E: Region of meristematic activity
(4) A: Region of meristematic activity, B: Region of elongation, C: Region of maturation, D: Root hair, E: Root cap

29. Cell recognition and adhesion occur due to biochemical of cell membranes named
(1) Proteins
(2) Lipids
(3) proteins and lipids
(4) Glycoproteins and glycolipids

30. Best material for the study of mitosis on laboratory is
(1) Anther (2) Root tip
(3) Leaf tip (4) Ovary

ZOOLOGY

31. Find out the total number of organisms given in the figure belonging to marine habitat.



(1) 1 (2) 3 (3) 4 (4) 5

32. The aves have additional chamber in digestive tract, where _____ is for food storage and _____ is for food grinding.
(1) Crop, gizzard
(2) Gizzard, crop
(3) Crop, pharynx
(4) Pharynx, gizzard

33. Association between suckerfish (Remora) and shark is
(1) Commensalism (2) Symbiosis
(3) Predation (4) Parasitism

34. Ducts of salivary glands and pancreatic duct are lined with which of the following epithelium?
(1) Simple squamous
(2) Compound epithelium
(3) Simple cuboidal
(4) Simple columnar

35. Brunner's gland
(1) Is situated in mucosal layer
(2) Is present in submucosal layer
(3) Secretes HCl
(4) Helps in the activation of gastric enzyme

36. Abducens nerve are injured in a human body. Which one of the following functions will be affected?
(1) Movement of the eye ball
(2) Movement of the tongue
(3) Swallowing
(4) Movement of the neck

37. Tympanic membrane consists of
(1) Skin on outside
(2) Connective tissue in the middle part
(3) Mucus membrane on inside
(4) All of these

38. Saliva in mouth and tears from eye protects from microbial infection. This type of barrier is known as
(1) Cellular (2) Physical
(3) Physiological (4) Cytokine

39. Carrier for amoebiases is
(1) Entamoeba histolytica
(2) Mosquito
(3) House flies
(4) Plasmodium vivax

40. Sustained high fever (39° to 40°C) and intestinal perforation in severe cases is a symptom of which disease?
(1) Malaria (2) Typhoid
(3) Cholera (4) Common cold