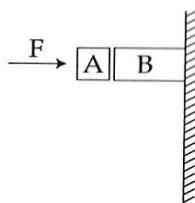


PHYSICS
QUESTIONS : 30 FULL MARKS : 75

Directions: Ques No 1 to 15 carry 2 marks each.
Select one correct answer for these questions

1. A spring has length l and spring constant K . If the spring is divided in two equal parts, then the spring constant is
 (A) K (B) $K/2$
 (C) $2K$ (D) $4K$
2. A step down transformer reduces 220V to 11V. The primary draws 5A current and secondary supplies 90A current. The efficiency of the transformer is
 (A) 90% (B) 33%
 (C) 20% (D) 4.4%
3. Total energy of an electron in the first excited state of hydrogen atom is -3.4 eV. Its kinetic energy in this state is
 (A) 3.4 eV (B) 6.8 eV
 (C) -3.4 eV (D) -6.8 eV
4. A transistor in C.E. mode contains load resistance $5K\Omega$ and input resistance $1K\Omega$. If the input peak voltage is 5 mV and the current gain is 50, voltage gain will be
 (A) 250 (B) 500
 (C) 125 (D) 50
5. A sonometer wire of length 1.5 m is made of steel. The tension in it produces an elastic strain of 1%. What is the fundamental frequency of steel if density and elasticity of steel are 7.7×10^3 kg / m³ and 2.2×10^{11} N/m² respectively ?
 (A) 188.5 Hz (B) 178.2 Hz
 (C) 200.5 Hz (D) 770Hz
6. Given in the figure are two blocks A and B of weight 20 N and 100 N, respectively. These are being pressed against a wall by a force F as shown. If the coefficient of friction between the blocks is 0.1 and between block B and the wall is 0.15, the frictional force applied by the wall on block B is



- | | |
|-----------|-----------|
| (A) 100 N | (B) 80 N |
| (C) 120 N | (D) 150 N |

7. The ionization energy of H_2 atom is 13.6 eV. Following Bohr's theory the energy corresponding to a transition between the 3rd and the 4th orbit is
 (A) 3.40 eV (B) 1.51 eV
 (C) 0.85 eV (D) 0.66 eV
8. A transformer drops 220 V to 11 V. The primary draws 1.0 A current and the secondary delivers 18 A. The efficiency of the transformer is
 (A) 20% (B) 44%
 (C) 90% (D) 108%
9. A P – n junction diode is made of a material with a band gap of 2.0 eV. The minimum frequency of the radiation that can be absorbed by the material is
 (A) 10×10^{14} Hz (B) 5×10^{14} Hz
 (C) 1×10^{14} Hz (D) 20×10^{14} Hz
10. Eight drops of water of 0.6 mm radius each merge to form a one big drop. If the surface tension of water is 0.072 N/m, the energy dissipated in the process is
 (A) $16\pi \times 10^{-7}$ J (B) $4.15\pi \times 10^{-7}$ J
 (C) $2.075\pi \times 10^{-7}$ J (D) $8\pi \times 10^{-7}$ J
11. An LCR series circuit with $R = 100 \Omega$ is connected to a 200 V, 50 Hz a. c. source. When only the capacitance is removed, the voltage leads the current by 60° . When only the inductance is removed, the current leads the voltage by 60° . The current in the circuit is
 (A) 2 A (B) 1 A
 (C) $\frac{\sqrt{3}}{2}$ A (D) $\frac{2}{\sqrt{3}}$ A
12. A source S_1 is producing, 10^{15} photons per second of wave length 5000 Å. Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100 Å. Then, (power of S_2) / (power of S_1) is equal to
 (A) 1.00 (B) 1.02
 (C) 1.04 (D) 0.98
13. A 50 Hz ac current of peak value 2 A flows through one of the pair of coils. If the mutual inductance between the pair of coils is 150 mH, then the peak value of voltage induced in the second coil is
 (A) 30π V (B) 60π V
 (C) 15π V (D) 300π V
14. Water rises up to a height h of a capillary tube of radius r . If the tube is replaced by a similar tube of half the radius, water will rise to a height
 (A) 4 h (B) 3 h
 (C) 2 h (D) $h / 2$
15. A 1 m metallic rod is being revolved in a vertical plane about one of its ends with an angular velocity of $5 \text{ rad}\cdot\text{s}^{-1}$. The earth's horizontal magnetic field is 0.2×10^{-4} T. The emf induced across the ends of the rod will be
 (A) 5 mV (B) 5×10^{-4} V
 (C) 50 mV (D) 50 μ V

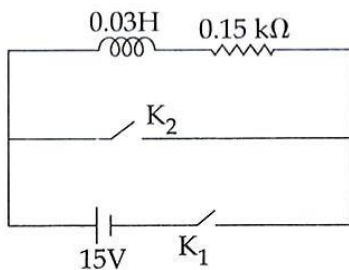
Directions: Ques No 16 to 30 carry 3 marks each.
Select one correct answer for these questions.

16. Identify the pairs whose dimensions are the same
- (i) Torque and work
 - (ii) Light-year and wavelength
 - (iii) Energy and power
 - (iv) Angular momentum and work
- (A) Only i
 (B) i and ii
 (C) ii and iii
 (D) I, ii and iii

17. Potential energy per unit volume of a stretched string is
- (A) $\frac{1}{2}$ stress \times strain
 (B) $\frac{1}{2}$ $\frac{\text{stress}}{\text{strain}}$
 (C) $\frac{1}{2}$ Young's modulus \times strain²
 (D) Both A and C

18. When 5V potential difference is applied across a wire of length 0.1 m, the drift speed of electrons is $2.5 \times 10^{-4} \text{ ms}^{-1}$. If the electron density in the wire is $8 \times 10^{28} \text{ m}^{-3}$, the resistivity of the material is close to
- (A) $1.6 \times 10^{-8} \Omega \text{m}$
 (B) $1.6 \times 10^{-7} \Omega \text{m}$
 (C) $1.6 \times 10^{-6} \Omega \text{m}$
 (D) $1.6 \times 10^{-5} \Omega \text{m}$

19. An inductor ($L = 0.03 \text{ H}$) and a resistor ($R = 0.15 \text{ k}\Omega$) are connected in series to a battery of 15V EMF in a circuit shown below. The key K_1 has been kept closed for a long time. Then at $t = 0$, K_1 is opened and key K_2 is closed simultaneously. At $t = 1 \text{ ms}$, the current in the circuit will be : ($e^5 \cong 150$)



- (A) 100 Ma
 (B) 67 mA
 (C) 6.7 mA
 (D) 0.67 mA

20. A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of 1 m from the diode is
- (A) 1.73 V/m
 (B) 2.45 V/m
 (C) 5.48 V/m
 (D) 7.75 V/m

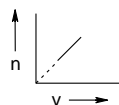
21. A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2 MHz. The frequencies of the resultant signal is/are
- (A) 2 MHz only
 (B) 2005 kHz, and 1995 kHz
 (C) 2005 kHz, 2000 kHz and 1995 kHz
 (D) 2000 kHz and 1995 kHz

22. If the linear momentum of a particle is $2.2 \times 10^4 \text{ Kg ms}^{-1}$, then what will be its de-Broglie wavelength? (Take $h = 6.6 \times 10^{-34} \text{ Js}$)
- (A) $3 \times 10^{-29} \text{ m}$ (B) $3 \times 10^{-29} \text{ nm}$
 (C) $6 \times 10^{-29} \text{ m}$ (D) $6 \times 10^{-29} \text{ nm}$
23. A body of mass 500 g is attached to a horizontal spring of spring constant $8\pi^2 \text{ Nm}^{-1}$. If the body is pulled to a distance of 10 cm from its mean position, then its frequency of oscillation is
- (A) 2 Hz (B) 4 Hz
 (C) 8 Hz (D) 0.5 Hz
24. The thermos e.m.f. E in volts of a certain thermocouple is found to vary with temperature difference Θ in $^\circ\text{C}$ between the two junctions according to the relation $E = 30\Theta - \frac{\Theta^2}{15}$. The natural temperature for the thermos-couple will be
- (A) 450°C (B) 400°C
 (C) 225°C (D) 30°C
25. A force $(4i + j - 2k) \text{ N}$ acting on a body maintains its velocity at $(2i + 2j - 3k) \text{ ms}^{-1}$. The power exerted is
- (A) 4 W (B) 5 W
 (C) 2 W (D) 8 W
26. In a hydrogen atom, the electron moves around the nucleus in a circular orbit of radius $5 \times 10^{-11} \text{ m}$. Its time period is $1.5 \times 10^{-16} \text{ seconds}$. The current associated with the electron motion is (Charge of electron is $1.6 \times 10^{-19} \text{ C}$)
- (A) 1.00 A (B) 1.066 mA
 (C) 1.81 mA (D) 1.66 mA
27. Light of two different frequencies, whose photons have energies 1 eV and 2.5 eV are respectively, successively illuminate a surface of work function 0.5 eV. The ratio of the maximum speeds of the electrons is
- (A) 2 : 1 (B) 1 : 2
 (C) 1 : 3 (D) 1 : 4
28. Two soap bubbles of radii r_1 and r_2 coalesce to form a bubble of radius r . Then r is equal to
- (A) $\sqrt{r_1^2 + r_2^2}$ (B) $\sqrt{r_1 + r_2}$
 (C) $r_1 + r_2$ (D) $(r_1 + r_2)/2$
29. If a bar magnet of pole strength m and magnetic moment M is cut equally 5 times parallel to its axis and again 3 times perpendicular to its axis, then the pole strength and magnetic moment of each piece are respectively
- (A) $m/20, M/4$ (B) $m/5, M/20$
 (C) $m/6, M/24$ (D) $m/5, M/24$
30. The half-life of a radioactive isotope X is 50 years. It decays to another element Y which is stable. The two elements X and Y were found to be in the ratio 1:15 in a sample of a given rock. The age of the rock was estimated to be
- (A) 150 years (B) 200 years
 (C) 250 years (D) 100 years

CHEMISTRY	
QUESTIONS : 30	FULL MARKS : 75

Directions: Ques No. 31 to 45 carry 2 marks each
Select one correct answer for these questions

31. For a given one mole of an ideal gas kept at 6.5 bar in a container of capacity 2.463 liter. The Avogadro proportionality constant for the hypothesis, is depicted in the figure



- (A) 0.406
(C) 2.46
- (B) 22.40
(D) 0.260
32. The Zinc / Silver oxide cell is used in electric watches. The reaction is as following,
- $$\text{Zn}^{2+} + 2 e \rightarrow \text{Zn} \dots \dots \dots E^{\circ} = - 0.760 \text{ V}$$
- $$\text{Ag}_2\text{O} + \text{H}_2\text{O} + 2 e \rightarrow 2 \text{Ag} + 2 \text{OH}^{-} \dots \dots \dots E^{\circ} = 0.344 \text{ V}$$
- If F is 96500 C mol^{-1} , $|\Delta G^{\circ}|$ of the cell will be
- (A) 113.072 kJ/mol
(C) 213.072 kJ/mol
- (B) 413.021 kJ/mol
(D) 313.072 kJ/mol
33. Identify the wrong statement in the following
- (A) Acid rain is mostly because of oxides of nitrogen and sulfur
(B) Chlorofluorocarbons are responsible for ozone layer depletion
(C) Green house effect is responsible for global warming
(D) Ozone layer does not permit infrared radiation from the sun to reach the earth
34. Which of the following halogen oxides is ionic?
- (A) ClO_2
(C) I_2O_5
- (B) BrO_2
(D) I_4O_9
35. For the square planar complex $[\text{Pt}(\text{NH}_3)(\text{NH}_2\text{OH})(\text{py})(\text{CH}_3)]^{+}$, how many geometrical isomers are possible?
- (A) 3
(C) 2
- (B) 1
(D) 4
36. Which one can not respond in Fehling's solution?
- (A) Glucose
(B) $\alpha\text{-D}(+)\text{ methyl glycoside}$
(C) Arabinose
(D) Galactose

37. What is the mass of the precipitate formed when 50 mL 16.9 % (W/V) solution of AgNO_3 is mixed with 50 mL 5.8 % (W/V) NaCl solution?
 [Given: $\text{Ag} = 107.8 \text{ u}$, $\text{N} = 14 \text{ u}$, $\text{O} = 16 \text{ u}$, $\text{Na} = 23 \text{ u}$ and $\text{Cl} = 35.5 \text{ u}$]

- (A) 28 g
(C) 7 g
- (B) 3.5 g
(D) 14 g

38. Among the following complex ions which one has the highest paramagnetic character

- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
(C) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
- (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
(D) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

39. A bottle of dry ammonia and a bottle of dry hydrogen chloride gas connected through a long tube are opened simultaneously at both ends at constant temperature and pressure, the white solid ring first formed will be

- (A) At the center of the tube
(B) Near the HCl bottle
(C) Near the NH_3 bottle
(D) Throughout the length of the tube

40. In the reaction, $\text{NaOH} + \text{Al}(\text{OH})_3 \rightarrow \text{NaAlO}_2 + 2\text{H}_2\text{O}$, then equivalent mass of $\text{Al}(\text{OH})_3$ is

- (A) 78
(C) 52
- (B) 26
(D) Unpredictable

41. Washing powder contains boron is

- (A) $\text{Na}_2[\text{B}_2(\text{OH})_4(\text{O}_2)_2] \cdot 6\text{H}_2\text{O}$
(B) $\text{Na}_2[\text{B}_2(\text{OH})_3(\text{O}_2)(\text{H}_2\text{O})] \cdot 5\text{H}_2\text{O}$
(C) $\text{Na}_2[\text{B}_2(\text{OH})_3(\text{H}_2\text{O})_2(\text{O}_2)_2]\text{OH} \cdot 4\text{H}_2\text{O}$
(D) None of these

42. The volume of 0.1M oxalic acid that can be completely oxidised by 20ml of 0.025M KMnO_4 solution is

- (A) 125 ml
(C) 12.5 ml
- (B) 25 ml
(D) 37.5 ml

43. In which of the following pairs of molecules/ions, the central atoms have sp^2 hybridization?

- (A) BF_3 and NH_2^-
(C) BF_3 and NO_2^-
- (B) NO_2^- and NH_3
(D) NH_2^- and H_2O

44. For a first order reaction $\text{A} \rightarrow \text{P}$, the temperature (T) dependent rate constant(k) was found to follow the equation $\log k = -(2000) \frac{1}{T} + 6.0$. The pre-exponential factor A and the activation energy (E_a) in Arrhenius equation respectively are

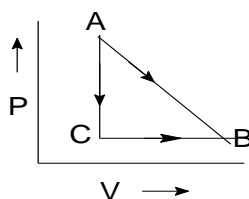
- (A) $1.0 \times 10^6 \text{ s}^{-1}$ and 9.2 kJ mol^{-1}
(B) $6.0 \times 10^6 \text{ s}^{-1}$ and 16.6 kJ mol^{-1}
(C) $1.0 \times 10^6 \text{ s}^{-1}$ and 16.6 kJ mol^{-1}
(D) $1.0 \times 10^6 \text{ s}^{-1}$ and 38.3 kJ mol^{-1}

45. Reduction of But-2-yne with Na in liquid NH_3 gives predominantly

- (A) n-Butane
(C) No reaction
- (B) Trans-2-butene
(D) Cis-2-butene

Directions: Ques. No. 46 to 60 carry 3 marks each.
Select 1 correct answer for these questions.

46. In the cyanide extraction process of silver from argentite ore, the oxidizing and reducing agents used are
(A) O_2 and CO respectively
(B) HNO_3 and Zn dust respectively
(C) O_2 and Zn dust respectively
(D) HNO_3 and CO respectively
47. The molarity of solution obtained by mixing 750 mL of 0.5 M HCl with 250 mL of 2 M HCl will be
(A) 1.00 M (B) 1.75 M
(C) 0.975 M (D) 0.875 M
48. In a cubic crystal of CsCl (density = 3.97g/cm^3) the eight corners are occupied by Cl^- ions with Cs^+ ions at the centre. The distance between the neighbouring Cs^+ and Cl^- ions is
(A) 4.21Å (B) 3.00Å
(C) 3.57Å (D) 4.75Å
49. Beckmann rearrangement is involved in the synthesis of which of the following polymers?
(A) PAN (B) Nylon-6,10
(C) Nylon-6 (D) Melamine
50. An organic molecule having formula C_7H_8O is soluble in NaOH solution and produces a blue violet colour with $FeCl_3$ solution. When reacted with Br_2 it forms a tribromide with formula $C_7H_5OBr_3$. The organic molecule is
(A) *m*-cresol (B) *p*-cresol
(C) *o*-cresol (D) Benzyl alcohol
51. 3.7 Ampere current was passed through 0.5 litre 2(M) $Ni(NO_3)_2$ solution for 6 hours in presence Ni electrode. The molarity of the solution after electrolysis will be
(A) 0.586 (B) 2.344
(C) 3.516 (D) 1.172
52. Consider the modes of transformation of a gas from state 'A' to state 'B' as shown in the following P – V diagram. Which one of the following is true?



- (A) $\Delta H = q$ along $A \rightarrow C$
(B) ΔS is same along both $A \rightarrow B$ and $A \rightarrow C \rightarrow B$

- (C) W is same along $A \rightarrow B$ and $A \rightarrow C \rightarrow B$
 (D) $W > 0$ along both $A \rightarrow B$ and $A \rightarrow C$

53. Cold ferrous sulfate solution on absorption of NO gas develops brown colour due to the formation of

- (A) Paramagnetic, $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4$
 (B) Diamagnetic, $[\text{Fe}(\text{H}_2\text{O})_5(\text{N}_3)]\text{SO}_4$
 (C) Paramagnetic, $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO}_3)](\text{SO}_4)_2$
 (D) Diamagnetic, $[\text{Fe}(\text{H}_2\text{O})_4(\text{SO}_4)]\text{NO}_3$

54. A metal crystallizes into two cubic phases, *fcc* and *bcc* whose unit cell lengths are 3.5\AA and 3.0\AA respectively. Calculate the ratio of densities of *fcc* and *bcc*.

- (A) 1.259 (B) 2.599
 (C) 1.599 (D) 5.009

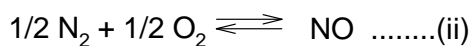
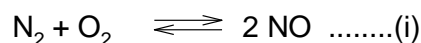
55. Formation of polyethylene from calcium carbide takes place as follows
 $\text{CaC}_2 + 2\text{H}_2\text{O} \rightarrow \text{Ca}(\text{OH})_2 + \text{C}_2\text{H}_2$, $\text{C}_2\text{H}_2 + \text{H}_2 \rightarrow \text{C}_2\text{H}_4$, $n\text{C}_2\text{H}_4 \rightarrow (-\text{CH}_2-\text{CH}_2-)_n$
 Thus the amount of polyethylene obtained from 64kg of CaC_2 is

- (A) 7 kg (B) 14 kg
 (C) 21 kg (D) 28 kg

56. The central atom carries maximum number of lone pairs of electron in which of the following compound or ion ?

- (A) ClO_3^- (B) XeF_4
 (C) SF_4 (D) I_3^-

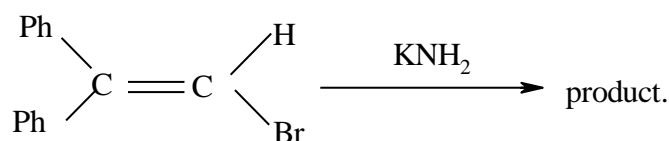
57. If K_1 and K_2 are equilibrium constants for reactions (i) and (ii) respectively,



then,

- (A) $K_1 = K_2$ (B) $\sqrt{K_1} = K_2$
 (C) $K_1 = 2K_2$ (D) $K_1 = \frac{1}{2}K_2$

58.



The product is

- (A) $\text{Ph}-\text{C} \equiv \text{C}-\text{H}$ (B) $\text{Ph}-\text{C} \equiv \text{C}-\text{Ph}$
 (C) $\text{Ph}-\text{C}(\text{Br}) \equiv \text{C}(\text{H})\text{Ph}$ (D) $\text{H}-\text{C} \equiv \text{C}-\text{H}$

59. In which of the following pairs, both the species are not iso-structural ?

- (A) SiC_4 and PCl_4^+ (B) Diamond and NH_4^+
 (C) NH_3 and PH_3 (D) XeF_4 and XeO_4

60. The best method for the preparation of 2, 2 - dimethyl butane is via the reaction of
- (A) $\text{Me}_2\text{C-Br}$ and $\text{MeCH}_2\text{-Br}$ in Na/ether
 - (B) $[(\text{Me}_3\text{C})_2. \text{Cu}] \text{Li}$ and $\text{MeCH}_2\text{-Br}$
 - (C) $[(\text{MeCH}_2)_2\text{Cu}] \text{Li}$ and $\text{Me}_3\text{C-Br}$
 - (D) Me_3CMgI and MeCH_2I