Mock Test 3 (02.03.2025)

180x4=720 MARKS

Solution

Physics

01. Answer **(1)**

Potential of a conducting sphere is

$V = \frac{KQ}{R}$ (Solid as well as hollow)

$V_1 = V_2$ and $R_1 = R_2$

so $Q_1 = Q_2$

02. Answer **(4)**

$$B_c = \frac{\mu_0 I}{4R} = \frac{4\pi \times 10^{-7} \times 3}{4 \times \frac{\pi}{10}}$$

$$B_c = 3 \times 10^{-6} T = 3\mu T$$

03. Answer **(2)**

04. Answer **(1)**

05. Answer **(3)**

by mirror formula

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v_1} + \frac{1}{-15} = \frac{1}{-20} \Rightarrow v_1 = 60cm$$

$$\frac{1}{v_2} + \frac{1}{-25} = \frac{1}{-20} \Rightarrow v_2 = -100cm$$

d = 60 + 100 = 160 cm

06. Answer **(3)**

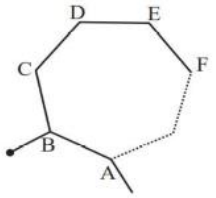
Tension (F) = mg

$$F = 4 \times \frac{10}{4} = 10N$$

$$\Delta L = \frac{FL}{AY} = \frac{10 \times 6}{3 \times 10^{-6} \times 2 \times 10^{11}}$$

$= 10^{-4}$m = 0.1 mm

07. Answer **(1)**



Suppose resistance of each arm is r, then r = R/n

$$R_{eq(AB)} = \frac{R_1 R_2}{R_1 + R_2}$$

$$= \frac{r(n-1)r}{r+(n-1)r} = \frac{n-1}{n} r \Rightarrow \frac{(n-1)R}{n^2}$$

08. Answer **(1)**

09. Answer **(4)**

$$V_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G\rho\frac{4}{3}\pi R^3}{R}}$$

$$\frac{V_{e1}}{V_{e2}} = \frac{R_1}{R_2}\sqrt{\frac{\rho_1}{\rho_2}} = \frac{1}{2} \Rightarrow \frac{\rho_1}{\rho_2} = \frac{1}{4} \times \frac{R_2^2}{R_1^2}$$

$$\frac{R_1}{R_2} = \frac{1}{3}$$

$$g \propto \rho R$$

$$\frac{g_1}{g_2} = \frac{\rho_1 R_1}{\rho_2 R_2} = \frac{1}{4}\frac{R_2^2}{R_1^2} \times \frac{R_1}{R_2}$$

$$= \frac{1}{4} \times \frac{R_2}{R_1} = \frac{3}{4}$$

10. Answer **(4)**

$$\Delta E = 13.6Z^2\left[\frac{1}{2^2} - \frac{1}{4^2}\right]eV$$

$$\Delta E = 13.6 \times 4^2\left[\frac{1}{4} - \frac{1}{16}\right]eV \Rightarrow \Delta E = 40.8eV$$

11. Answer **(4)**

$$< u_E > = < u_B > = \frac{1}{2} < u_{total} >$$

$$\frac{< u_E >}{< u_{total} >} = \frac{1}{2}$$

12. Answer **(1)**

13. Answer **(1)**

$K_{max} = hf - hf_0$

for $f = 2f_0 \Rightarrow \frac{1}{2}mv_1^2 = 2hf_0 - hf_0 = hf_0$

for $f = 5f_0 \Rightarrow \frac{1}{2}mv_2^2 = 5hf_0 - hf_0 = 4hf_0$

$\frac{v_1}{v_2} = \frac{1}{2}$

14. Answer **(1)**

$u = 20m/s, S_1 = 500m, v = 0$

$0 = (20)^2 - 2a.500 \Rightarrow a = \frac{4}{10}m/s^2$

$u = 20m/s, S_2 = 250m, v = ?$

$v^2 = (20)^2 - 2a.250$

$= v = \sqrt{200}m/s$

$x = 200$

15. Answer **(3)**

$F = 5 + 3y^2$

$W = \int_2^5 (5+3y^2)dy = \left[5y + \frac{3y^3}{3}\right]_2^5$

$W = 132J$

16. Answer **(4)**

$I = I_{cm} + Md^2$

$I = \frac{MR^2}{2} + MR^2 \Rightarrow \frac{3}{2}MR^2$

$x = 3$

17. Answer **(1)**

For A mass number = 34
Total binding energy = 1.2 × 34 = 40.8 MeV
For B mass number = 26
Total binding energy = 1.8 × 26 MeV
= 46.8 MeV
Difference of BE = 6 MeV

18. Answer **(1)**

$U_i + K_i = U_f + K_f$

$\frac{1}{2}kx_0^2 + 0 = \frac{1}{2}k\frac{x_0^2}{4} + 0.25$

$\frac{1}{2}kx_0^2\frac{3}{4} = \frac{1}{4}$

$\frac{1}{2}k\frac{3}{100} = 1 \Rightarrow \frac{200}{3}N/m$

$= 67N/m$

19. Answer **(1)**

20. Answer **(4)**

21. Answer **(4)**

22. Answer **(1)**

23. Answer **(1)**

24. Answer **(2)**

25. Answer **(3)**

$g_{eff} = g - \omega^2 R_e \sin^2\theta$, $\theta \rightarrow$ co-latitude angle

$g_{eff} = g\left(1 - \frac{d}{R}\right)$, d here depth

26. Answer **(3)**

27. Answer **(2)**

28. Answer **(1)**

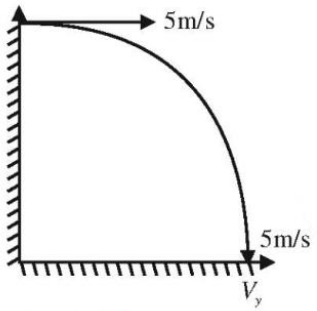
$v_{(escape)plant} = \sqrt{\frac{2GM_p}{R_p}}$

$= \sqrt{\frac{2G(M_e/9)}{(R_e/2)}} = \frac{v_e\sqrt{2}}{3}$ $\therefore$ x = 2

29. Answer **(2)**

$v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{70}{7.0\times10^{-3}}} = 100$ m/s

30. Answer **(2)**



$v_y = \sqrt{2gh} = \sqrt{200}$

$v_{net} = \sqrt{25 + 200} = 15$ m/s

31. Answer **(2)**

$KE = \frac{p^2}{2m} = \frac{h^2}{2m\lambda^2}$

$\frac{KE_p}{KE_\alpha} = \frac{m_\alpha}{m_p} = 4:1.$

32. Answer **(4)**

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$

$TV^{1/2} = T_2 (2V)^{1/2}$

$T_2 = \frac{T}{\sqrt{2}}$

$W = \frac{R(T_1 - T_2)}{\gamma - 1} = \frac{R\left(T - \frac{T}{\sqrt{2}}\right)}{1/2} = RT(2 - \sqrt{2})$

33. Answer **(3)**

$\nu_d = \frac{i}{neA}$ and $\nu_d' = \frac{E}{\rho \times 2l \times n \times e}$

$= \frac{E}{R \times neA} \Rightarrow \frac{E \times A}{\rho \times l \times n \times e \times A} \Rightarrow \frac{E}{\rho \times l \times n \times e}$

$\Rightarrow \frac{\nu_d'}{\nu_d} = \frac{1}{2}$ $\Rightarrow \nu_d' = \frac{\nu_d}{2}$

34. Answer **(4)**

Assuming RHS to be $\hat{n}$

$\vec{E}_I = \frac{\sigma}{2\epsilon_0}(-\hat{n}) + \frac{\sigma}{2\epsilon_0}(-\hat{n}) = -\frac{\sigma}{\epsilon_0}\hat{n}$

$\vec{E}_{II} = 0,$

$\vec{E}_{III} = \frac{\sigma}{2\epsilon_0}(\hat{n}) + \frac{\sigma}{2\epsilon_0}(\hat{n}) = \frac{\sigma}{\epsilon_0}(\hat{n})$

35. Answer **(1)**

Initial surface energy $= 0.45 \times 4\pi (10^{-3})^2$

$\frac{4}{3}\pi(10^{-3})^3 = 125 \times \frac{4\pi}{3} R_{new}^3 \quad \therefore 10^{-3} = 5R_{new}$

$\therefore \quad R_{new} = \frac{10^{-3}}{5}$ m

So, final surface energy $= 0.45 \times 125 \times 4\pi \left(\frac{10^{-3}}{5}\right)^2$

Increase in energy $= 0.45 \times 4\pi \times (10^{-3})^2 \left[\frac{125}{25} - 1\right]$

$= 4 \times 0.45 \times 4\pi \times 10^{-6}$

$= 2.26 \times 10^{-5}$ J

36. Answer **(2)**

BE of Helium $= (2m_P + 2m_N - m_{He})c^2$

= 28.4 MeV

37. Answer **(3)**

[b] = [V]

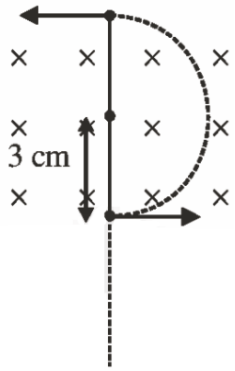
$\left[\frac{a}{b^2}\right] = [P] \quad \therefore \left[\frac{b^2}{a}\right] = \frac{1}{[P]} = \frac{1}{[B]} = [K]$

38. Answer **(1)**

Translational K.E on average of a molecule is 3/2 KT which is independent of nature, pressure and volume.

39. Answer **(1)**

$r = \frac{mv}{qB} = \frac{\sqrt{2km}}{qB}, \; m = \frac{r^2 q^2 B^2}{2k}$



$m = \frac{\frac{1}{100} \times \frac{3}{100} \times 2 \times 2 \times 4 \times 10^{-3} \times 4 \times 10^{-3} \times 10^{-12}}{2 \times 100 \times 10^{-6}}$

$= 144 \times 10^{-18}$ kg

40. Answer **(2)**

$W = \vec{F}.(\vec{r}_f - \vec{r}_i)$

$= (5\hat{i} + 2\hat{j} + 7\hat{k}).((5\hat{i} - 2\hat{j} + \hat{k}) - (2\hat{i} + 3\hat{j} - 4\hat{k}))$

W = 40 J

41. Answer **(4)**

To maximize the average rate at which energy supplied i.e. power will be maximum.

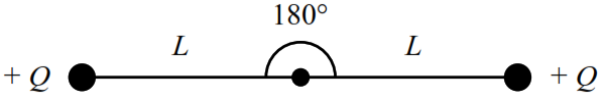
So in LCR circuit power will be maximum at the condition of resonance and in resonance condition

$X_L = X_C \quad 79.6 = \frac{1}{\omega C} \quad \therefore C = \frac{1}{2\pi \times 50 \times 79.6}$

$\therefore$ C = 40 μF

42. Answer **(1)**

The position of the balls in the satellite will become as shown below.



Thus, angle θ = 180° and Force $= \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q^2}{(2L)^2}$

43. Answer **(2)**

The value of high resistance (R) that should be connected in series with the galvanometer of resistance G for converting it into a voltmeter of

range 0 to V is given by $R = \frac{V}{I_g} - G$ and $I_g = \frac{V}{G}$ For increasing its range to nV, R should be changed to $R' = \frac{nV}{\left(\frac{V}{G}\right)} - G$

$\therefore R' = nG - G = G(n - 1)$.

44. Answer **(2)**
Magnetic moment of coil = $NIA\hat{j}$
$= NI(\pi r^2)\,\hat{j}$
Torque on loop (coil) = $\vec{M} \times \vec{B}$
$= NI(\pi r^2)\, B \sin 90^o\, (-\hat{k})$
$= NI\,\pi r^2\, B(-\hat{k})$.

45. Answer **(1)**
Both electric and magnetic fields have sinusoidal nature in a plane electromagnetic wave. As we know, the average value of a sinusoidal wave is zero, so both magnetic and electric fields have average values of zero.

Chemistry

46. Answer **(3)**
All Cu(II) halides are known except CuI_2

47. Answer **(1)**
orrect order of 3rd ionisation enthalpy
Sc < Ti < V < Cr

48. Answer **(4)**
Ti^{+2}, V^{+2}, Cr^{+2} act as reducing agent in aqueous solution

49. Answer **(2)**
Assertion: Fluorine stablises higher oxidation state of transition metals.
Reason: Oxygen ahs ability to form double bond with transition metals.

50. Answer **(4)**
The lanthanoids having only one electron in penultimate d-subshell in ground state.
Ce, Gd, Lu

51. Answer **(3)**
Phenol is carbolic acid.

52. Answer **(2)**
Ether synthesis occur in williomson's synthesis.

53. Answer **(3)**
This is example of free radical subsitution reaction.

54. Answer **(3)**
Two σ-bonds formed between carbon and hydrogen.

55. Answer **(4)**
C.No. 6 means octahedral arrangement.

56. Answer **(3)**
Halogens are most electro negative. so (3) is correct option.

57. Answer **(2)**
use $\frac{K_{t_2}}{K_{t_1}} = \gamma^{\frac{\Delta t}{10}}$

58. Answer **(3)**
Order w.r.t A is 2 and w.r.t B is zero.

59. Answer **(1)**
$$\log K_c = \frac{2E^0_{cell}}{.059}$$
$$\frac{6 \times .059}{2} = E^0_{cell}$$
E^0_{cell}=.177 so 1 option is correct.

60. Answer **(1)**
At anode there will be no deposition of Cu.

61. Answer **(2)**
I.E = –55.4 + 57.3 = 1.9 KJ/mole

62. Answer **(4)**
All can show metamerism.

63. Answer **(2)**
All alkene can not show geometrical isomerism i.e., aaC = Caa type.

64. Answer **(3)**
2 σ bond b/w C and C and 1 σ bond b/w C and H

65. Answer **(1)**
More bulky means higher degree of carbon and hence more stable carbocation, so SN^1 is favoured.

66. Answer **(2)**
This is FRA so homolysis occur

67. Answer **(3)**
2,3,4 are identical to huckle's rule.

68. Answer **(1)**
It will give four ions and hence minimum freezing points.

69. Answer **(3)**
Total sum of p, e^- & neutron = 18
so in 1 mole carbon there will be = 1.08×10^{25} particle.

70. Answer **(4)**
No. of atom = Mole x N_0 x atomicity

71. Answer **(4)**
No. of mole = M x V x 2

72. Answer **(3)**
1/100 moles of $CaCO_3$ will give = 0.01 mole of CO_2
= 0.01 x 22.4 L at STP
= 0.224 L

73. Answer **(4)**

74. Answer **(4)**
$A_2 + B_2 \rightleftharpoons 2\,AB$
K 0.5K K
$\Delta H_f = K + .5\,K - 2\,K$
$-200 = -.5\,K$
K = 400 KJ mol^- and hence bond energy will be = 400 KJ/mol

75. Answer **(1)**
'SiO_2' is only non metal and hence its oxide will be acidic.

76. Answer **(2)**
$_{17}Cl = 1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
for $2p^6$ n + l = 3
No. of electron = 6
For $3s^2$ n + l = 3
Total electron = 8

77. Answer **(3)**
Structure of BF_3 is trigonal planar with six electron.

78. Answer **(4)**
In ClF_3 molecule, Cl–atom is sp^3d hybridized and due to the presence of two lone pairs of electrons on central atom it has a T–shaped geometry.

79. Answer **(4)**
T = 16 day
$t_{1/2}$ = 4 day

$$n = \frac{T}{t_{1/2}} = \frac{16}{4} = 4$$

As, $N = N_0 \times \left(\frac{1}{2}\right)^n$

$$= 1 \times \left(\frac{1}{2}\right)^4 = \frac{1}{16}$$

80. Answer **(3)**
$CuSO_4$ act as catalyst in Kjeldahl's method of estimation of nitrogen.

81. Answer **(4)**
The terminating step is completed with coupling so (4) is correct option.

82. Answer **(3)**
$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
$\Delta_{ng} = 1 - 1 = 0$
So $\Delta H = \Delta E$

83. Answer **(3)**
Use $\Delta H = \Delta E + \Delta ng\, RT$
$30 = \Delta E + 3 \times 2 \times 10^{-3} \times 500$
$\Delta E = 30 - 3$
= 27 kcal / mol

84. Answer **(4)**
In SO_2 and SO_3 the different of oxidation no. is greatest.

85. Answer **(3)**

$$22.2 = \frac{177}{n_f \times 96500} \times 2.0 \times 5 \times 60 \times 60$$

$$n_f = \frac{177 \times 2 \times 5 \times 60}{96500 \times 22.2} \times 60 = 2.97$$

So (3) is correct option.

86. Answer **(2)**

$$\log k_c = \frac{1 \times 2}{.059} = 33.89$$

k_k = anti log 33.81 = 10^{33} so this is equilibrium constant.

87. Answer **(3)**

$$E^0_{cell} = E^0_c - E^0_a = 0.34 - (-76)$$

$$E^0_{cell} = 1.10\ V$$

88. Answer **(3)**
As 2^0 Benzyl corbocation are much more stable than other given product.

89. Answer **(1)**
 can activate the benzene ring so it is 'o' and 'p' director.

90. Answer **(1)**
As degree of dissociation increase and hence ionic product increases with temperature.

Biology

091. Answer **(1)**
092. Answer **(1)**
093. Answer **(4)**
094. Answer **(2)**
095. Answer **(4)**
096. Answer **(4)**
097. Answer **(2)**
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