5.1 CHAPTER

OFFICIAL SUPR SAMPLE PAPER

1. Choose the correct alternative that will continue the same pattern and fill in the blank spaces. 2, 7, 14, 23, ___, 47
   (a) 34 (b) 31 (c) 38 (d) 27 (e) None of these

2. It is postulated that huge deposits of NaCl (rock salt) and $CaCO_3$ (chalk and marble) are sites of erstwhile oceans, where the salts had been concentrated through weathering by rain and wind and leaching by rivers. Select the correct explanatory statement in this context.
   (a) Both NaCl and $CaCO_3$ are highly soluble in water.
   (b) NaCl is soluble in water but $CaCO_3$ is not. Hence, concentration of $CaCO_3$ in the oceans through weathering is an untenable hypothesis.
   (c) The solubility of $CaCO_3$ in water is pH dependent and is enhanced by acidic atmospheric gases. Hence, $CaCO_3$ may be leached into water during weathering.
   (d) NaCl and $CaCO_3$ are igneous rocks and have crystallized as such during the slow cooling process when the earth was born. Hence, the ocean postulates are baseless.

3. A known positive charge is located at point P as shown above, between two unknown charges, Q1 and Q2. P is closer to Q2 than Q1. If the net electric force acting on the charge at P is zero, it may correctly be concluded that:
   (A) Both Q1 and Q2 are positive
   (B) Both Q1 and Q2 are negative
   (C) Q1 and Q2 have opposite signs
   (D) Q1 and Q2 have the same sign, but magnitude of Q1 is greater than the magnitude of Q2

4. If log2 = 0.30103 and log3 = 0.4771, find the number of digits in $(648)^5$.
   (a) 23. (b) 15. (c) 13. (d) 14. (e) 22.

5. Which of the following solutions, when mixed, will not form a buffer solution?
   (a) 100 mL 0.1 M NaOH + 50 mL 0.1 M CH_3COOH
   (b) 50 ml 0.1 M NaOH + 100 mL 0.1 M CH_3COOH
   (c) 50 mL 0.1 M NH_4OH + 50 mL 0.1 M CH_3COOH
   (d) 50 ml 0.1 M HCl + 100 mL 0.1 M CH_3COONa

6. A man can cover a distance in 1hr 24min by covering 2/3 of the distance at 4 km/h and the rest at 5km/h. The total distance is
   (a) 2km (b) 5km (c) 6km (d) 10km (e) None of these

7. Three identical masses are at the three corners of the triangle, connected by massless identical springs (rest length l0) forming an isosceles right-angle triangle. If the two sides of equal length (of length 2l0) lie along positive x-axis and positive y-axis, then the force on the mass that is not at the origin but on the x-axis is given by axˆ+ byˆwith
   (a) a = 1 and b = 0

(b) a = 0 and b = 1
(c) a = -√2 and b = 1
(d) a = - 2 and b = 0
(e) a = - 2 and b = 1

8. Asim got thrice as many sums wrong as he got right. If he attempted 60 sums in all, how many sums did he solve correctly?
(a) 25 (b) 12 (c) 20 (d) 10 (e) 15

9. A system consists of N particles, interacting with each other (for example, protein molecule). Which one of the following statements is FALSE?
(a) The motion of the system can be split into translational, rotational and vibrational motions
(b) Number of rotational degrees of freedom are 3
(c) Number or translational degrees of freedom are 3
(d) Number of vibrational degrees of freedom are 3
(e) The system, if isolated, will conserve both total energy and total angular momentum.

10. Three pipes A, B and C can fill a tank in 6 hrs. After working at it together for 2 hrs C is closed and A and B can fill the remaining part in 7 hrs. The total number of hrs taken by C alone to fill the tank is
(a) 14 (b) 12 (c) 11 (d) 10 (e) 13

11. A square closed loop of area A, lying in the horizontal plane, is moving horizontally with velocity v in a uniform vertical magnetic field B. Which one of the following statements is FALSE?
(a) There is current in the loop even though there is no battery (or any other voltage source)
(b) The work done in moving the coil is being converted to the current in the coil
(c) The current is being generated because the magnetic field is doing the work.
(d) the emf generated is proportional to the velocity of the coil (e) the emf generated is proportional to the magnetic field strength

12. Two liquids A and B are mixed in such a proportion that they form an ideal solution who's total vapor pressure is exactly three times that of the partial pressure of A. If PA° and PB° are the vapor pressures of pure A and B respectively, then the total vapor pressure of the solution is given by Options:
(a) $\frac{2P_A^\circ P_B^\circ}{3P_A^\circ + P_B^\circ}$ (b) $\frac{3P_A^\circ P_B^\circ}{P_B^\circ + 2P_A^\circ}$ (c) $\frac{2P_A^\circ}{2P_A^\circ + P_B^\circ}$ (d) $\frac{2P_B^\circ}{P_A^\circ + 2P_B^\circ}$
(e) more data needed to solve the problem

13. If P_o and P_s are the vapour pressures of the solvent and solution respectively and X0 and Xs are mole fractions of solvent and solute respectively, then
(a) $P_0 = X_s P_S$ (b) $P_S = X_0 P_0$ (c) $P_0 = X_0 P_S$ (d) $P_S = X_s P_0$

14. The velocity of the nitrogen molecule in room temperature air is:
(a) zero (b) 10 m s-1 (c) 100 m s -1 (d) 500 m s -1 (e) 5000 m s -1

15. Helium is two times heavier than H2. The average kinetic energy per molecule for helium at 300K is
(a) twice as H2 (b) same as H2 (c) half as H2 (d) one fourth of H2

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---------- Answers ----------

1	A	2	C	3	D	4	B	5	A
6	C	7	E	8	E	9	C	10	A
11	C	12	B	13	B	14	C	15	B

---------- Solutions ----------

1. Difference (Next term – Previous term) between two consecutive No. is in AP, i.e., Difference between No is 5, 7, 9, 11, 13.
   So, 23+11=34.

2. Direct Statement From NCERT.
   The solubility of $CaCO_3$ in water is pH dependent and is enhanced by acidic atmospheric gases. Hence, $CaCO_3$ may be leached into water during weathering.

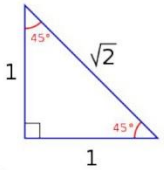
3. To Balance the Forces, it is clear that Q1, Q2 must have same sign of charges by which Both will Attract or Both will Repel to Balance the forces.
   As the Distance of the positive charge placed between Q1 and Q2 is not same from Q1 and Q2, So the Magnitude of electric force on positive charge by Q1 and Q2 will be different. $F = kq_1q_2/d$ as $F \sim 1/d$ (Inversely Proportion) so in between Q2 & P as d is Less Hence F is more to Balance it so, Q2 must be more.

4. You must know and Remember that No. of Significant Digit before decimal = $[(\text{Characteristic})_{\text{base }10} + 1]$
   To find $(\text{Characteristic})_{\text{base }10}$,
   Revise Topics Mentioned in UGEE SUPR Guide Available on IIITprep.com
   $\text{Log}(648)^5 = 5(\log 648) = 5(\log 2^3.3^4) = 5[3.\log 2 + 4.\log 3]$
   $= 5[3(0.301) + 4(0.4771)]$
   $(\text{Characteristic})_{\text{base }10} = 14$
   So, the no. Of significant digits before decimal is 14+1 = 15.

5. Buffer Solution is a Solution which Resist change in pH when acid or base is added to it.
   For a Buffer Solution: Existence of both weak part & its Conjugate is Required.
   $NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$
   In (A) As NaOH is more than CH_3COOH so, CH_3COOH will be the LR (Limiting Reagent) and will be finished & NaOH will remain in solution and no conjugate will be formed.

6. Revise Topics from UGEE SUPR Guide Available on IIITprep.com
   Say Total Distance be d
   Speed = distance / time (convert 1 hour 24 minutes to hour)
   $(2d/3)/4 + (d/3)/5 = 1 + 24/60$
   So, get d = 6 Km
   Extra: - To convert from km/h to m/s multiply km/h with 5/18.

7. Que Directly from NCERT Exemplar Available on IIITprep.com SUPR Book
   Mainly 2 types of forces are Considered here
   1. Gravitational Force
   2. Spring Force



The Spring force is $-kx^2$ where x is Elongation. Now take the Proper Direction of Forces. Resolve its Component along x axis & y axis i.e. $-2\hat{i} + \hat{j}$ so, a = -2 & b = 1

8. Say If He got x Sums right
So, He gets 3x sums Wrong. So, 60 = x + 3x.
So, x = 15

9. A. True, Translational, Rotational, Vibrational are types of Motion.
B. True, Rotational Degree = 3 as per KTG
C. False, Translational Degree = 2 as per KTG
D. True, Vibrational Degree = 3 as per KTG
E. True, In Isolation, Conservation of Energy & Angular Momentum is valid.

10. First Understand How to Solve this type of Work Problem Revise **Time & Work Section** from SUPR & REAP Guide Book from IIITprep.com.
Say Pipe A can do a piece of work in 1 hr
Say Pipe B can do b piece of work in 1 hr
Say Pipe C can do c piece of work in 1 hr
So, (a+b+c)6 = 1 ---------- 1st Condition
(a+b+c)2 + (a+b)7 = 1 ---------- 2(1/6) + (a+b)7 = 1
So, a+b = 2/21 ---------- Eqn 1
So, c = 1/6 – 2/21 = 1/14
Now C can do 1/14 piece of work Hence, 1 piece of work can be done by C in 14 days.

11. A. True, EMF will be induced by Motional EMF
B. True, Conservation of Work & Energy. Coz, Work done by Magnetic Field is zero.
C. False, always work done by Magnetic Field is Zero because, Direction of Force and Displacement are Perpendicular so, Dot Product is Zero always.
D. True, E = [V×B. dl] where, V = Velocity and E = EMF
E. True, E = (V×B). dl where B = Magnetic Field and E = EMF

12. Revise Main Topics from IIITprep SUPR BOOK @ IIITprep.com
You must Know: Total Pressure $P_T = P_A + P_B$ Where P_A is Partial Pressure
And $P_A = P^0_A X_A$ where P^0_A = Vapor Pressure and X_A = Mole Fraction of A
Similarly, for $P_B = P^0_B X_B$
We Know $X_A + X_B = 1$ ---------- Sum of Mole Fractions
Given: $P_T = 3\ P_A = P_A + P_B$
$= 3\ P^0_A X_A$ --------- 3
So, $2P_A = P_B$
$2P^0_A X_A = P^0_B X_B$ --------- 1
$X_A + X_B = 1$ --------- 2
From 1 & 2 we get $XA = P^0_B / (2P^0_A + P^0_B)$ Put X_A in 3 We Get Ans as
$P_T = 3P^0_A P^0_B/(2P^0_A+P^0_B)$

13. Revise Main Topics from IIITprep SUPR BOOK @ IIITprep.com
$P_{SA} = P^0_A X_A$ General Formula to Be Remembered. Direct Que From NCERT.
Acc. To rault's law
Po-PS whole divided by Po is equal to the mole fraction of solute which is Xs
Xs + Xo=1

14. Direct from NCERT But Approximate Value can be Calculated
By, $V_{rms} = \sqrt{}(3RT/M)$ Formula
Nitrogen molecule contains 28 nucleons and nitrogen atom contains 14 nucleons.

15. Method (1)
KE α mv^2 Velocity α √ (T/M) as V_{rms} = √ (3RT/M)
KE α MT/M Velocity^2 α (T/M)
KE α Temp
So, as Temp is Constant, KE will Remain Constant so, it is Independent of Masses.

Method (2)
As the average Kinetic energy of a particle in an ideal gas equation is: -
KE=3/2kT, where k is Boltzmann's constant and T is temperature
By this formula we can see that at a constant temperature, average kinetic energy remains constant and is independent of mass.

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