

IIITH UGEE Subject Proficiency Test (SUPR) Question Paper

Time Allowed :1 Hour	Maximum Marks :50	Total Questions :50
-----------------------------	--------------------------	----------------------------

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The Duration of test is 1 Hour.
2. This paper consists of 50 Questions.
3. The test includes Physics, Chemistry and Mathematics (PCM) questions.
4. There will be 50 questions in total from the subject proficiency test section with English as the medium of instruction/ paper.
5. The test has 25 percent negative marking which means 0.25 mark will be deducted for each wrong answer and one mark will be rewarded for each correct answer.

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 CaCO₃ (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 CaCO₃ are highly soluble in water.
 - (b) NaCl is soluble in water but CaCO₃ is not. Hence, concentration of CaCO₃ in the oceans through weathering is an untenable hypothesis.
 - (c) The solubility of CaCO₃ in water is pH dependent and is enhanced by acidic atmospheric gases. Hence, CaCO₃ may be leached into water during weathering.
 - (d) NaCl and CaCO₃ are igneous rocks and have crystallized as such during the slow cooling process when the earth was born. Hence, the ocean postulates is 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 $\log 2 = 0.30103$ and $\log 3 = 0.4771$, 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 CH₃COOH
 - (b) 50 mL 0.1 M NaOH + 100 mL 0.1 M CH₃COOH
 - (c) 50 mL 0.1 M NH₄OH + 50 mL 0.1 M CH₃COOH
 - (d) 50 mL 0.1 M HCl + 100 mL 0.1 M CH₃COONa
-

6. A man can cover a distance in 1 hour 24 minutes by covering $\frac{2}{3}$ of the distance at 4 km/h and the rest at 5 km/h. The total distance is

- (a) 2 km
 - (b) 5 km
 - (c) 6 km
 - (d) 10 km
 - (e) None of these
-

7. Three identical masses are at the three corners of the triangle, connected by massless identical springs (rest length l_0) forming an isosceles right angle triangle. If the two sides of equal length (of length $2l_0$) lie along the 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 $\hat{i} + \hat{j}$ with a and b .

- (a) $a = 1$ and $b = 0$
 - (b) $a = 0$ and $b = 1$
 - (c) $a = -\sqrt{2}$ 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 molecules). 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 of 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 hours 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 whose total vapor pressure is exactly three times that of the partial pressure of A. If P_A° and P_B° are the vapor pressures of pure A and B respectively, then the total vapor pressure of the solution is given by

- (a) $\frac{P_A^\circ P_B^\circ}{2} + P_A^\circ + P_B^\circ$
 - (b) $3P_A^\circ + P_B^\circ$
 - (c) $\frac{P_A^\circ}{2} + P_B^\circ$
 - (d) $P_A^\circ + 2P_B^\circ$
 - (e) More data needed to solve the problem
-

13. If P_0 and P_S are the vapour pressures of the solvent and solution respectively and X_0 and X_S 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
 - (c) 100 m/s
 - (d) 500 m/s
 - (e) 5000 m/s
-

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
-