

Do. Believe and Conquer.

2019 HSC CHEMISTRY LECTURE GIFT

1000 QUESTIONS
(FREE RESPONSE & MCQ QUESTIONS)

PART V
(500/1000)

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Best,
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Question 401: Describe the intermolecular force present between amine molecules.

Question 402: Describe the intermolecular forces present between amide molecules.

Question 403: Describe the intermolecular forces between carboxylic acid molecules.

Question 404: Describe the difference in physical properties between comparable primary, secondary and tertiary amines.

Question 405: Describe the differences in chemical properties between comparable amine and amides.

Question 406: Describe the differences in primary properties for comparable primary, secondary and tertiary alcohols.

Question 407: Describe the procedure that you used during your HSC Chemistry course to analyse the acidity or basicity of a common household substance.

Question 408: Write a balanced chemical equation for the reaction between copper carbonate and nitric acid.

Question 409: Write a balanced chemical equation for the reaction between sulfuric acid and magnesium metal.

Question 410: Calculate the resulting pH of a 100mL NaOH solution if it is diluted with water to a final volume of one litre.

Question 411: Explain whether it is possible to dilute an acid solution such that the resulting pH of the diluted acid solution has a pH that exceeds 7.

Question 412: Explain whether it is possible to dilute a base solution such that the resulting pH of the diluted base solution has a pH that is lower than 7.

Question 413: A ten-fold dilution refers to which of the following?

- (A) The final volume of the solution is 10% more than the original volume.
- (B) The final volume of the solution is 10% less than the original volume.
- (C) The final volume of the solution is half of the original volume.
- (D) The final volume of the solution is 1/10 of the original volume.

Question 414: Describe the reason for strong acids being better electrical conductors than weak acids provided their molarity are the same.

Question 415: Describe a situation where a weak acid can have the same pH as a strong acid.

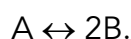
Question 416: Oxalic acid has the molecular formula, $C_2H_2O_4$. Calculate the change in pH when a 0.3M solution of oxalic acid is diluted by ten-fold. You are given that the acid dissociation constant for oxalic acid is 6.0×10^{-2} .

Question 417: Describe what it means for a solution to be saturated.

Question 418: Which of the following is true about a saturated solution of sodium chloride?

- (A) The dissolution reaction of sodium chloride has stopped.
- (B) There is an equilibrium is established between the dissolution of sodium chloride and the formation of solid sodium chloride.
- (C) Since sodium chloride is highly soluble in water, no equilibrium or saturated solution can be established.
- (D) There are no macroscopic observable changes in a saturated solution of NaCl.

Question 419 - Random True/False Question – Suppose you poured equal moles of Gas A and B into a closed system that is capable of establishing an equilibrium:



Since the moles and concentration of Gas A and B are equal, an equilibrium must be established.

Question 420: Which of the following is false about the factors used to calculate the rate constant in the Arrhenius's equation?

- (A) Temperature of reaction.
- (B) Activation energy of reaction and ideal gas law constant.
- (C) The frequency factor ('A') of reaction which is governed by frequency of collision and probability of favourable collision orientation.
- (D) All of the above.

Question 421: The reaction rate can be calculated using the Arrhenius equation which incorporates temperature, frequency factor ('A'), ideal gas constant, activation energy.

Explain why the equilibrium constant is only dependent on temperature despite it being derived from the Arrhenius equation.

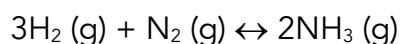
Question 422: Which of the following is true when reacting species are said to have the correct or favourable collision orientation?

- (A) The collision energy is greater than the bond energy for one of the bonds that is required to be broken in one of the reactants necessary to form the products.
- (B) The collision energy of the reacting species is equal or greater than the activation energy.
- (C) The required reacting species are colliding to form the products.
- (D) The atoms of the reacting species are colliding at the correct angle and distance.

Question 423: Explain the reason why an increase in concentration would result in an increase in rate of reaction.

Question 424: Describe the mechanism in which catalysts increase the rate of reaction using the collision theory.

Question 425: For the following reaction,



Describe the relationship between increasing pressure and rate of reaction using the collision theory.

Question 426: Describe the relationship between increasing volume and rate of reaction using the collision theory.

Question 427: Describe the relationship between increasing surface area and rate of reaction.

Question 428: Distinguish the terms rate constant and rate of reaction.

Question 429: Describe the relationship between the strength of bonds in reactants and the rate of reaction to form products.

Question 430: Describe the relationship between activation energy and rate of reaction using collision theory.

Question 431: Describe the relationship between activation energy and the rate constant of a reaction.

Question 432: Describe the relationship between temperature and the rate constant of a reaction.

Question 433: A faulty electrical wiring caused a spark resulting in a combustion reaction to occur. Which of the following statement can be said to be true about the event?

- (A) The spark is reactant of the combustion reaction.
- (B) The spark provided the activation energy necessary for the combustion reaction to occur.
- (C) The spark increased the amount of reacting species with the effective collision necessary for the combustion to occur.
- (D) The spark provided an alternative reaction pathway for the combustion reaction to occur.

Question 434 – True or False Question – In order for a dynamic equilibrium to be established, the system's temperature must be constant.

Question 444: A phase equilibrium can be established between liquid water and water vapour in a closed system with a wet towel as shown below.



If the temperature of the system is allowed to be maintained constant, explain whether or not the towel will remain damp?

Question 445: What is the percent yield of HI at equilibrium given that you initially added 3.7 moles of H_2 and 3.2 moles of I_2 respectively into a closed 1.0L vessel. You are given that, at equilibrium, the mole of HI is 4.2.

Question 446: Suppose that the equilibrium constant value for the formation of gaseous HI from H_2 and I_2 gases is 55 at a certain temperature, calculate the equilibrium constant value for the decomposition of HI at the same states of matter and temperature.

Question 447: Which of the following statements about the equilibrium constant value is false?

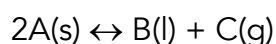
- (A) The K_{eq} value is independent of the presence or absence of a catalyst.

- (B) The K_{eq} value is dependent on the system's temperature
- (C) The K_{eq} value is lower if the system favours reactants more than products.
- (D) Solids and liquids are generally included the equilibrium law expression for heterogenous equilibrium reactions.

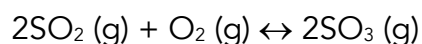
Question 448 - Extension question - Calculate the equilibrium concentration of carbonic acid, hydrogen carbonate ion, and carbonate ion present in acidified water with a pH of 5.6. You are given that the equilibrium concentration of CO_2 is 0.00001M.

You are given that the first acid dissociation (K_{a1}) of carbonic acid to be 4.3×10^{-7} and the second acid dissociation (K_{a2}) of carbonic acid to be 5.6×10^{-11} .

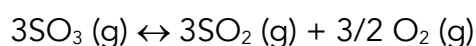
Question 449: Explain the effect on the equilibrium position for the following reaction at dynamic equilibrium when 2 grams of solid A is added.



Question 450: Suppose that equilibrium constant value for the following equation is 120 at a certain temperature.



Calculate the K_{eq} value for the following equilibrium.



Question 451: For the following equation, explain why the direction in which the equilibrium position will shift with the addition of water into the closed system.



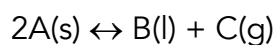
Question 452: Distinguish between molar solubility and solubility product constant.

Question 453: A student told you that "weak acids become strong when they are dilute."

Explain whether or not you agree with the student.

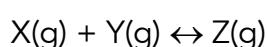
Question 454: Distinguish between macroscopic and microscopic properties used to describe equilibrium reactions, providing an example of each.

Question 455: If some amount of solid are removed from the equilibrium system as shown below.



It was documented that there is no sharp spike drop in the concentration of A(s) observed. Explain the reason why.

Question 456: If there is a sudden spike showing the drop in the concentration of gas X involved in the reaction equilibrium below.



Which of the following factor is possible in resulting in the sudden drop in the concentration of gas X?

- (A) Change in system's temperature
- (B) Increase in system's volume.
- (C) Addition of a catalyst.
- (D) Removal of some amount of Z from the system.

Question 457: Write an K_c expression for a saturated solution of oxygen in water. Assume that there is no oxygen gas in the water initially and oxygen is later pumped in to establish equilibrium.

Question 458: Write the chemical equation for the reaction between butan-2-ol and propanoic acid, showing reaction conditions and the structural formula of all reactants and products.

Question 459: Explain why a chemical reaction at static equilibrium is considered irreversible?

Question 460: List two factors that will determine whether the collision between two molecules will result in a chemical reaction.

Question 461 – Prelim Q to prepare you for Advanced HSC Q - List two factors that could affect the chemical rate of reaction.

Question 462: Indicators are often used in replace of expensive pH meters as they are cheaper but comes with the cost of producing less accurate results when

determining when equivalence point is reached which affects the average titre volume.

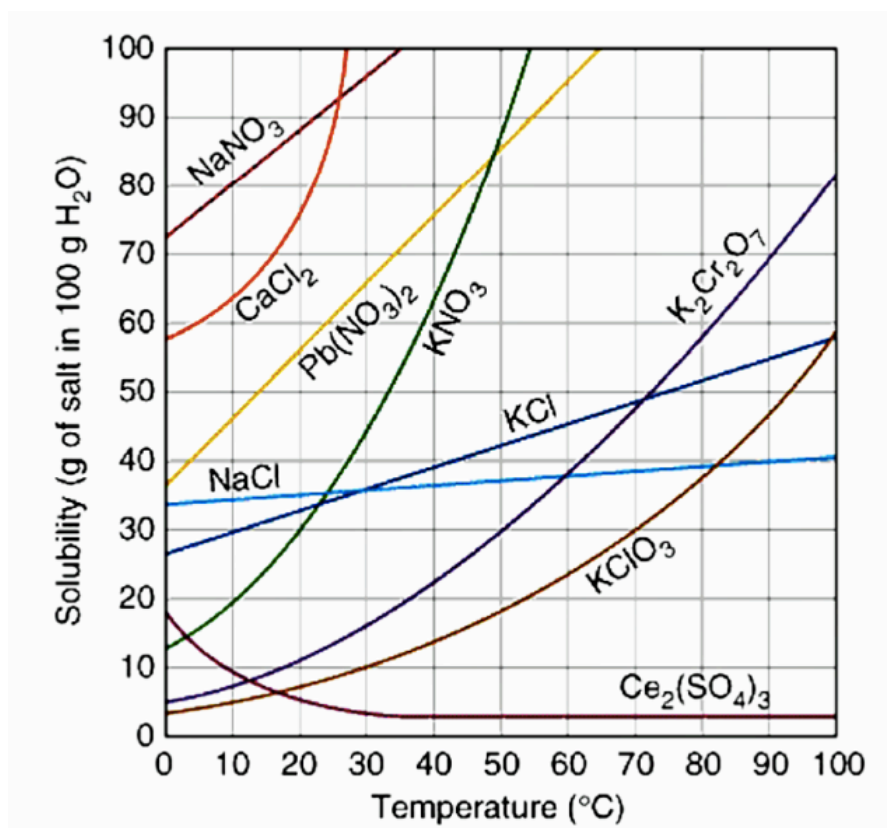
Justify a reason for small volume of indicator to be used during a titration experiment.

Question 463: Describe how you could separate the following cations present in a solution with nitrate ions.



Question 464: Describe the nature of salt solutions, illustrated in the solubility graph below, if the amount of solute is water is:

- (a) Below the salt's solubility curve,
- (b) Above the salt's solubility curve
- (c) On the salt's solubility curve



Source: <https://commons.wikimedia.org/wiki/File:SolubilityVsTemperature-9.svg>

Question 465: Calculate the solubility product constant for aluminium chloride, given that 100 grams of the substance is necessary to create a saturated solution in water.

Question 466: Relating to the microscopic level, outline is occurring when equilibrium has been reached?

Question 467: Describe a chemical test used to distinguish amines and amides.

Question 468: A Na_3PO_4 solution is diluted by from 30mL to 300mL. The diluted sodium phosphate solution is later titrated with AgNO_3 to allow a precipitate to form. The precipitate was filtered where the filtrate was subsequently titrated against potassium thiocyanate. The data obtained from each titration is shown in the table below.

Volume of AgNO_3 used to titrate with Na_3PO_4 to form precipitate.	60.00mL
Concentration of AgNO_3	0.072M
Volume of KSCN used	5.03mL
Concentration of KSCN	0.0531

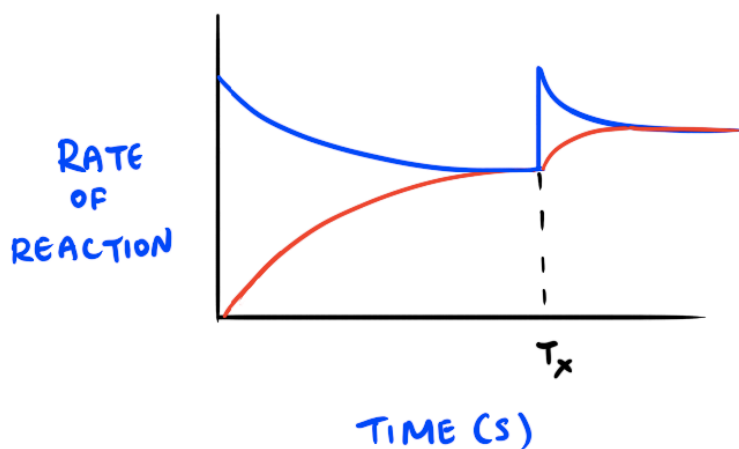
Calculate the concentration of PO_4^{3-} ions present in the undiluted Na_3PO_4 solution.

Question 469: Which of the following statement(s) is/are true for a system at dynamic equilibrium?

- I. The rates of the forward and reverse reactions are equal
- II. The macroscopic properties of the system such as kinetic and collision energies of reactants are constant.
- III. Mass of reactants is equivalent to the mass of products

- (A) I only
(B) I and II
(C) I and III
(D) I, II and III.

Question 470: Referring to the rate against time graph below for the decomposition of hydrogen iodide.



Given that the blue line represents the forward rate of reaction and the red line is the reverse rate of reaction, which of the following is true?

- (A) Hydrogen iodide gas is pumped into the bulb.
- (B) Hydrogen gas is pumped into the bulb.
- (C) A catalyst is added into the bulb.
- (D) The bulb's volume is reduced.

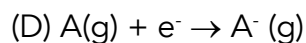
Question 471: State a reason to why the experimental value of K_{sp} may be different to the theoretical value.

Question 472: Write the base dissociation constant expression for the weak base, $(C_2H_5)_2NH$, that partially ionises in water.

Question 473: Calculate the pH of the buffer that is comprised of 800mL of ethanoic acid and 650mL of potassium acetate. You are given that the respective concentrations of the ethanoic acid and potassium acetate are 0.15M and 0.20M respectively.

Question 474: In which of the following reaction is the change in entropy decreasing?

- (A) $A_2B_3 \rightarrow 2A(s) + 3/2 B_2$
- (B) $A(s) \rightarrow A(l)$
- (C) $A_2(g) \rightarrow 2A(g)$



Question 475: Which of the following substance, when added, will alter the molar solubility of iron (II) carbonate dissolved in water.

- (A) KNO_3
- (B) HNO_3
- (C) $NaCl$
- (D) CH_4

Question 476: Calculate the solubility product constant for mercury sulfide given that the molar solubility of the compound is 5.5×10^{-27} .

Question 477: Which of the following salts does not have their solubility dependent on pH?

- (A) BaF_2
- (B) $BaCO_3$
- (C) BaC_2O_4
- (D) $BaCl_2$

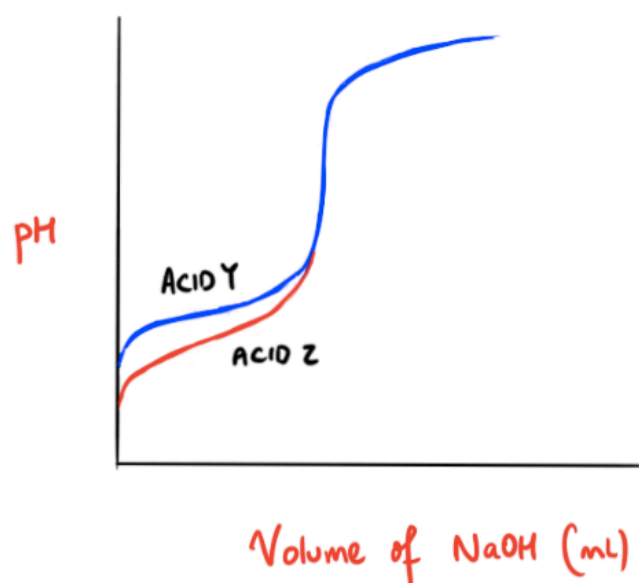
Question 478: Justify whether or not both of the following 0.5M solutions will have a higher solubility in an acid solution compared to water.

Concentration	Solution
0.5M	$BaSO_4$
0.5M	$BaCO_3$

Question 479 – Random True or False Question – Catalyst increases the rate of the forward and reverse reactions equally, allowing equilibrium position to be reached faster. However, the reaction enthalpy of reaction is different when a catalyst is used than without.

Question 480 – Random True or False Question – If temperature is altered, both the equilibrium constant value and equilibrium concentrations are altered.

Question 481: The graph below shows two titration curves produced by titrating equal volumes of monoprotic acids Y and Z against NaOH. The sodium hydroxide solution used for the titration with acids Y and Z is the same.



Which of the following statement is true with given the information?

- (A) Acid Y is a stronger acid than acid Z, however, both acids have the same molarity.
- (B) Acid Y is a weaker acid than acid Z, however, both acids have the same molarity.
- (C) Acid Y has a lower molarity than Acid Z, however, both acids are equal in strength.
- (D) Acid Y has a higher molarity than Acid Z, however, both acids are equal in strength.

Question 482: Which of the following pair of substances is will result in a buffer when dissolved together in water.

- (A) 0.5 mol of NaOH and 0.5 mol of HCl
- (B) 0.5 mol of KCl and 0.7 mol of HCl
- (C) 0.5 mol of HNO_2 and 0.25 mol of KOH
- (D) 0.5 mol of NH_3 and 0.5 mol of HCl

Question 483: An unknown solution is diluted by 10 folds with water. The resulting pH after dilution is raised by one compared to the pH prior to dilution. Which of the following best describes the unknown solution?

HINT: 10 folds is diluting the solution by a factor of 10.

- (A) A buffer
- (B) A weak acid

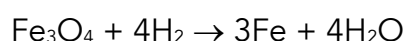
- (C) A strong acid
- (D) A strong base

Question 484: Explain whether or not a Bronsted-Lowry acid such as hydrogen carbonate ion will always produce an acidic solution.

Question 485: Describe the state of equilibrium using the acid-base theory proposed Bronsted and Lowry.

Question 486: Distinguish the terms 'polymer' and monomer'.

Use the following equation to answer Questions 487 – 488



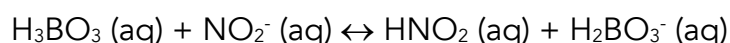
Question 487: Calculate the mass of iron that can be obtained through the reaction of the iron oxide with hydrogen gas. You are given that the mass of the iron oxide is 35 grams with a percentage purity of 57%.

Question 488: Suppose that another sample the iron oxide is allowed to react with hydrogen gas. Assume that the mass of the sample is 256 grams where the reaction formed 42 grams of iron. Calculate the % purity of the iron oxide sample.

Question 489: Suppose that 35 grams of solid potassium oxide is allowed to react with carbon dioxide to form solid potassium carbonate and oxygen gas. You are given that 14.2 grams of potassium carbonate is formed. Calculate the percentage yield of the reaction.

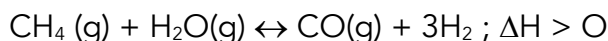
Question 490: Solid potassium oxide, with percentage purity of 72.4%, is allowed to react with carbon dioxide to form solid potassium carbonate and oxygen gas. Calculate the mass of solid potassium oxide required to produce 200 grams of potassium carbonate.

Question 491: For the reaction below, what is the amphiprotic species?



- (A) HNO_2
- (B) H_2BO_3^-
- (C) NO_2^-
- (D) H_3BO_3

Question 492: Suppose neon gas is added into a closed system with the following equilibrium established:



Describe the effect that will result on the system.

Question 493: Draw the structural formula of 3-ethyl-2,2,5,5-tetramethyloctane.

Question 494: Which of the following true about organic chemistry?

- (A) It is the study of molecules with carbon.
- (B) It is the study of metals.
- (C) It is the study of living things.
- (D) It is the study of molecules produced by living things.

Question 495: Which of the following is an appropriate general formula for the alkyne homologous series?

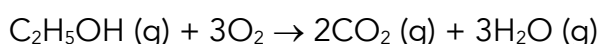
- (A) C_nH_{n-2}
- (B) $\text{C}_n\text{H}_{2n-2}$
- (C) C_nH_{4n}
- (D) $\text{C}_n\text{H}_{2n+2}$

Question 496: Name the class of organic compound that is produced from the oxidation of ethanal, stating the reaction condition necessary.

Question 497: Which of the following monomer is used to make the polymer with the formula, $(-\text{CH}_2\text{CCl}_2\text{CH}_2\text{CCl}_2-)$?

- (A) $\text{HC}=\text{CCl}$
- (B) $\text{ClHC}=\text{CClH}$
- (C) $\text{Cl}_2\text{C}=\text{CH}_2$
- (D) $\text{H}_2\text{C}=\text{CClH}$

Question 498: When burned in excess oxygen, ethanol produces carbon dioxide and water according to the equation below.



Which of the following represents the closest volume of gas produced from the reaction above when 0.25 mole of the alcohol is combusted?

Suppose that the reaction above occurred at 200 kelvin and 1 atmospheric pressure.

- (A) 8L
- (B) 10L
- (C) 12L
- (D) 14L

Question 499: Calculate the atmospheric pressure that 5 grams of methane gas exerts on a closed bulb that has a volume of 2.4L at a temperature of 132 degrees Celsius.

Question 500: Which of the following will not affect the rate of an irreversible chemical reaction occurring in a closed system?

- (A) Adding a catalyst into the reaction.
- (B) Removing one mole of product from the system.
- (C) Raising the system's temperature.
- (D) Lowering the concentration of the reactant.