State of Israel
Ministry of Education
Exam Type: *Bagrut*
Exam date: Summer 2019
Exam number: 37381
Attachments: (1) Periodic table
(2) Electronegativity table
(3) Formulas for calculations
(4) Functional groups
English translation (3)

Chemistry

Instructions for examinees

א. Duration of the exam: Three hours

ב. Exam structure and breakdown of points:
This exam has two parts.

Part One	— Required	—	40 points
Part Two	—	—	60 points
	Total	—	100 points

ג. Material that may be used during the exam:
(1) A calculator (graphing calculators are permitted).
(2) A Hebrew-foreign language/foreign language-Hebrew dictionary.

ד. Special instructions:
(1) **Note:** In Part One, there are nine **required** questions.
For each of Questions 1-8, four possible answers are given and you must choose the correct answer.
Mark the correct answers on the answer sheet found at the end of the answer booklet (page 19).
You must answer all of the items in Question 9.
(2) In Part Two, there are five questions. You must answer three of them.

Write in the answer booklet only. Write the word "טיוטה" at the top of each page you use as a draft page. If you write any draft material outside the answer booklet, your exam may be disqualified.

Good Luck!

מדינת ישראל
משרד החינוך
סוג הבחינה: בגרות
מועד הבחינה: קיץ תשע"ט, 2019
מספר השאלון: 37381
נספחים: (1) הטבלה המחזורית
(2) טבלת אלקטרושליליות
(3) נוסחאות לחישובים
(4) קבוצות פונקציונליות
תרגום לאנגלית (3)

כימיה

הוראות לנבחן

א. משך הבחינה: שלוש שעות.

ב. מבנה השאלון ומפתח ההערכה:
בשאלון זה שני פרקים.

פרק ראשון	– חובה	– 40 נקודות
פרק שני		– 60 נקודות
	סה"כ	– 100 נקודות

ג. חומר עזר מותר בשימוש:
(1) מחשבון (כולל מחשבון גרפי).
(2) מילון עברי-לועזי / לועזי-עברי.

ד. הוראות מיוחדות:
(1) **שים לב:** בפרק הראשון יש תשע שאלות **חובה**.
בכל אחת מן השאלות 1-8 מוצגות ארבע תשובות, ומהן עליך לבחור בתשובה הנכונה.
את התשובות הנכונות עליך לסמן בתשובון שבסוף מחברת הבחינה (עמוד 19).
בשאלה 9 יש לענות על כל הסעיפים.
(2) בפרק השני יש חמש שאלות. עליך לענות על שלוש מהן.

כתוב במחברת הבחינה בלבד. רשום "טיוטה" בראש כל עמוד המשמש טיוטה. כתיבת טיוטה בדפים שאינם במחברת הבחינה עלולה לגרום לפסילת הבחינה.

בהצלחה!

Questions

Part One (40 points)

Answer the eight questions, 1-8 (each question – 2.5 points).

Before you answer, read all the possible answers.

Four possible answers are presented for each question. Choose the correct one.

* Mark the answer you chose on the answer sheet on the inside cover at the end of the answer booklet (page 19).
* For each question, use a pen to mark an X in the box below the letter (א-ד) that represents the answer you chose.
* Mark an X in only one box for each question.
* If you want to erase your answer, fill in the whole box like this: ■ .
* Do **not** use White-Out to erase answers.
* **Note: In order to limit the need to erase answers on the answer sheet, we recommend that you first mark the correct answers inside the exam booklet itself and only later mark them on the answer sheet.**

1. The table below presents information about the composition of three particles, arbitrarily labeled X, Y, and Z.

Particle	Number of protons	Number of neutrons	Electron configuration
X	8	10	2 , 8
Y	9	10	2 , 8
Z	8	8	2 , 6

Which statement is correct?

א. Particles X and Y are isotopes of the same element.

ב. Particles X and Z have the same nuclear charge.

ג. The three particles, X, Y, and Z, are negative ions.

ד. Particle Y represents a neon atom, Ne.

/continued on page 3/

2. Sodium, $Na_{(s)}$, reacts with phosphorus, $P_{4(s)}$.

What is the empirical formula of the compound created in this reaction?

א. NaP_4

ב. NaP_3

ג. Na_3P

ד. Na_4P

3. Given: three substances in liquid state.

$CH_3CH_2F_{(\ell)}$, $CH_3CH_2OH_{(\ell)}$, $CH_3CH_2NH_{2(\ell)}$

Read the following four statements, א-ד, about the intermolecular forces [כוחות הפועלים בין המולקולות] in each of these substances.

Which statement is correct?

א. Intermolecular hydrogen bonds occur in each of the three substances.

ב. The hydrogen bonds between molecules of $CH_3CH_2NH_{2(\ell)}$ are stronger than the hydrogen bonds between $CH_3CH_2OH_{(\ell)}$ molecules.

ג. The bonds between molecules of $CH_3CH_2F_{(\ell)}$ are stronger than the bonds between $CH_3CH_2OH_{(\ell)}$.

ד. Only Van der Waals interactions occur between molecules of $CH_3CH_2F_{(\ell)}$.

4. Given: two containers, A and B, each with a volume of 1 liter.

Container A is full of the gas methane, $CH_{4(g)}$.

Container B is full of the gas oxygen, $O_{2(g)}$.

The temperature and the pressure in both containers are the same.

Which statement is correct?

א. The number of moles of gas in Container A is equal to the number of moles of gas in Container B.

ב. The number of molecules of the gas in Container B is double the number of molecules of the gas in Container A.

ג. The mass of the gas in Container A is equal to the mass of the gas in Container B.

ד. The mass of the gas in Container A is double the mass of the gas in Container B.

/continued on page 4/

5. Below is the equation of an oxidation-reduction reaction.

$$4NH_{3(g)} + 6NO_{(g)} \longrightarrow 5N_{2(g)} + 6H_2O_{(g)}$$

Which statement is correct?

א. The gas $NO_{(g)}$ is the reducer.

ב. The electrons are transferred from the N atoms in the NO molecules to the N atoms in the NH_3 molecules.

ג. When 1 mole of $NH_{3(g)}$ reacts, 3 moles of electrons are transferred.

ד. $N_{2(g)}$ is a product of the reduction of $NH_{3(g)}$.

6. Below are the equations of three reactions, (1)-(3).

(1) $K_2O_{(s)} + H_2O_{(\ell)} \longrightarrow 2K^+_{(aq)} + 2OH^-_{(aq)}$

(2) $K_{(s)} + H_2O_{(\ell)} \longrightarrow K^+_{(aq)} + \frac{1}{2}H_{2(g)} + OH^-_{(aq)}$

(3) $KHSO_{4(s)} + H_2O_{(\ell)} \longrightarrow K^+_{(aq)} + SO^{2-}_{4(aq)} + H_3O^+_{(aq)}$

In which reaction(s) does the water, $H_2O_{(\ell)}$, react as a base?

א. Only in Reaction (1).

ב. Only in Reaction (2).

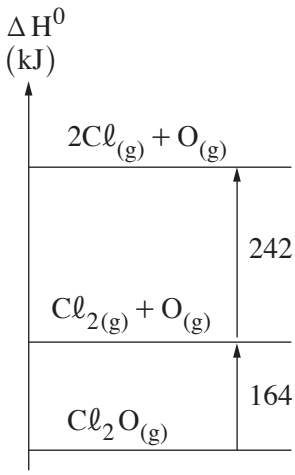
ג. In Reaction (1) and in Reaction (2).

ד. Only in Reaction (3).

/continued on page 5/

7. On the right is a diagram of changes in enthalpy.

What is the enthalpy of the bond $O-C\ell$ in the compound $C\ell_2O_{(g)}$?



א. $406\frac{kJ}{mo\ell}$

ב. $203\frac{kJ}{mo\ell}$

ג. $164\frac{kJ}{mo\ell}$

ד. $82\frac{kJ}{mo\ell}$

8. When a solution of hydrochloric acid, $HC\ell_{(aq)}$, is mixed with a solution of sodium thiosulfate, $Na_2S_2O_{3(aq)}$, a reaction occurs.

Below is the net equation of this reaction:

$$2H_3O^+_{(aq)} + S_2O^{2-}_{3(aq)} \longrightarrow 3H_2O_{(\ell)} + SO_{2(g)} + \frac{1}{8}S_{8(s)}$$

Students investigated the reaction and proposed different measures of the reaction rate. Read the four suggestions, I-IV, for obtaining information about the reaction rate that the students proposed.

I Measure the electrical conductivity of the solution at the end of the reaction.

II Measure the pH of the solution at the end of the reaction.

III Measure electrical conductivity of the solution at regular intervals.

IV Measure the pH of the solution at regular intervals.

Which <u>two</u> suggestions are the most suitable?

א. I and II

ב. I and IV

ג. II and III

ד. III and IV

/continued on page 6/

Analysis of a Passage from a Scientific Article - Required

9. Read the passage below and answer all the items א-ד that follow (required question – 20 points).

Carbon dioxide: from undesirable by-product to future resource

Global warming and the resulting climate change is one of the problems facing the human race in the 21st century. The increase in concentration of the gas carbon dioxide, $CO_{2(g)}$, in the atmosphere is one of the contributing factors to global warming and the rise in average global temperature. Rising concentrations of $CO_{2(g)}$ stem, in part, from the increasing quantities of hydrocarbon fuels and coal, $C_{(s)}$, being burned to supply energy.

Scientists, industrialists, and governments must find ways to reduce $CO_{2(g)}$ emissions to the atmosphere.

Replacing coal and hydrocarbon fuels with renewable sources of energy (such as solar and wind) is one solution currently being pursued.

A revolutionary approach to $CO_{2(g)}$, explored in recent years, views $CO_{2(g)}$ as a raw material and source of carbon atoms for the chemical industry rather than as an undesirable by-product. The goal is to capture $CO_{2(g)}$ emitted from combustion processes, mainly at power stations, and utilize it to produce a variety of carbon compounds that are currently produced from a dwindling global supply of petroleum.

Figure 1 shows some of the carbon compounds that can be produced from $CO_{2(g)}$:

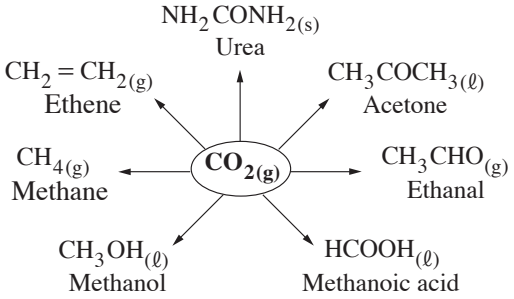


Figure 1

These compounds can be used to produce many substances that serve as fuel or raw materials in the chemical industry.

To utilize $CO_{2(g)}$ as a raw material, two difficulties must be overcome:
— separating $CO_{2(g)}$ from the other gases emitted by the power stations
— high energy costs of manufacturing these compounds.

Implementing the solutions to these difficulties is a challenge facing chemists and other scientists today.

Source: Clarke J. (2017), Carbon dioxide can be a versatile chemical feedstock for a variety of industries, Chemistry World.

/continued on page 7/

א. Diesel is a hydrocarbon fuel used in power stations.

The hydrocarbon $C_{12}H_{26(\ell)}$ is one of the components of diesel.

i Based on the passage, determine whether the reaction for obtaining $CO_{2(g)}$ from a hydrocarbon fuel is exothermic or endothermic. Explain.

ii Formulate and balance the reaction in which $CO_{2(g)}$ is obtained from the hydrocarbon $C_{12}H_{26(\ell)}$.

ב. i Select four compounds that can be produced from $CO_{2(g)}$ (shown in Figure 1). Copy the following table to your answer booklet and fill in the missing information.

	Name of compound	**Formula of functional group**	**Name of functional group**
1			
2			
3			
4			

ii Three of the compounds in Figure 1 are liquid at room temperature.
One of the three compounds is methanoic acid.
The boiling point of methanoic acid is higher than the boiling point of the other two compounds.
Explain this fact. In your answer, discuss the intermolecular forces [כוחות הפועלים בין המולקולות] that operate between the molecules of each of the three compounds.

ג. i To produce methanol, $CH_3OH_{(\ell)}$, from $CO_{2(g)}$, an additional substance is required. Determine whether the additional substance in this reaction reacts as an oxidizer or as a reducer. Explain.

ii This reaction takes place with a special catalyst [זרז] composed of the metals palladium, $Pd_{(s)}$, and copper, $Cu_{(s)}$, at a temperature in the range of 180°C to 250°C. The reaction rate with this catalyst is faster. Explain this fact using collision theory [תורת ההתנגשויות].

ד. Based on the passage, list two benefits of utilizing $CO_{2(g)}$ emissions into the atmosphere to manufacture a variety of carbon compounds.

/continued on page 8/

Part Two (60 points)

Answer three of the questions 10-14 (each question – 20 points).

Atomic Structure, Periodicity, Structure and Bonding

10. There are over 70 elements in the materials from which smartphones are built: metals and nonmetals, abundant elements and rare elements.

א. The main components of the glass panel (display glass) of a smartphone screen are: silicon dioxide, $SiO_{2(s)}$, sodium oxide, $Na_2O_{(s)}$, and aluminum oxide, $A\ell_2O_{3(s)}$.

i Copy the following table to your answer booklet and fill in the missing information.

	$SiO_{2(s)}$	**$A\ell_2O_{3(s)}$**
Type of particles in the substance		
Type of bonds between the particles		

ii Write Lewis electron dot structures [נוסחאות ייצוג אלקטרוניות] for the particles of which the compound $Na_2O_{(s)}$ is composed.

iii To strengthen the glass panel, some of the sodium ions are displaced by larger ions. This is achieved by immersing the glass panel in a suitable molten ionic compound. Determine which compound is suited to this process: lithium nitrate, $LiNO_{3(\ell)}$, or potassium nitrate, $KNO_{3(\ell)}$. Explain your answer.

ב. The touchscreen under the glass panel is composed of a transparent layer of indium oxide, $In_2O_{3(s)}$, and other materials.

The most common isotope of indium is $^{115}_{49}In$.

How many protons, neutrons, and electrons, respectively, are there in the indium particles of the compound $^{115}In_2O_{3(s)}$?

/continued on page 9/

ג. The electronic chip is composed of silicon, $Si_{(s)}$, with some added atoms of other elements such as: phosphorus, ${}_{15}P$, gallium, ${}_{31}Ga$, or arsenic, ${}_{33}As$.

i The first ionization energy of silicon, Si, is $789\frac{kJ}{mo\ell}$.

The first ionization energy of phosphorus, P, is $1012\frac{kJ}{mo\ell}$.

Explain why the first ionization energy of phosphorus, P, is higher than the first ionization energy of silicon, Si.

ii Given: two values of ionization energy: $947\frac{kJ}{mo\ell}$ and $1251\frac{kJ}{mo\ell}$.

Which is the correct value for the first ionization energy of arsenic, As? Explain.

ד. Graphite, $C_{(s)}$, is one of the substances in smartphone batteries.

i List three properties of the microscopic structure of graphite.

ii Graphite conducts electric current. Explain why.

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Food Chemistry, and Energy

11. Butter is a high-fat food produced from milk or cream in a process called churning.

א. Fat accounts for 99.4% of the calorific value of butter.

The calorific value of 100 grams of butter is 733 kilocalories.

Given: The calorific value of 1 gram of fat is 9 kilocalories.

Calculate how many grams of fat there are in 100 grams of butter.

Provide detailed calculations.

Scientists have discovered that butter contains more than 200 types of triglycerides. The following table shows the main fatty acids from which triglycerides in butter are composed.

Fatty acid	**Symbol**	**Fatty acid shorthand notation**	**Percent**
Myristic acid	M	C14:0	12%
Palmitic acid	P	C16:0	26%
Stearic acid	S	C18:0	11%
Oleic acid	O	C18:1ω9 , cis	28%

ב. When butter is taken out of the refrigerator and placed at room temperature, it softens and becomes easy to spread.

The following triglycerides are present in butter:

MOO , SPS , SPM , MPO , SPP , POO

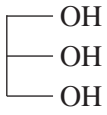
Three of the triglycerides in the list make butter soften at room temperature.

Which three triglycerides are they? Explain why they make butter soften.

/continued on page 11/

ג. Butyric acid, C4:0, is a component of a small percentage of triglycerides in butter. When butter spoils, the hydrolysis of these triglycerides produces butyric acid which has an unpleasant odor.

i The triglyceride SPB is one of the triglycerides which contain butyric acid.
The letter B is the symbol of butyric acid.
Write the abbreviated structural formula for the triglyceride SPB.
Given: the abbreviated structural formula of the molecule glycerol



ii The interactions between the molecules of the triglyceride SPB are weaker than the interactions between the molecules of the triglyceride SPP. Explain what causes this.

ד. Fatty acids, in the form of triglycerides, are stored in the body in fat cells and are used as a source of energy. Fatty acids in the cells undergo a chain of processes in which carbon dioxide, $CO_{2(g)}$, and water, $H_2O_{(\ell)}$, are produced. This is similar to the full combustion reaction of carbon compounds.

Reaction (1) below is the combustion reaction of butyric acid.

(1) $C_3H_7COOH_{(\ell)} + 5O_{2(g)} \longrightarrow 4CO_{2(g)} + 4H_2O_{(\ell)} \qquad \Delta H^0_{(1)} = ?$

Below are three reactions, I-III:

I. $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} \qquad \Delta H^0_{I} = -393.5\ kJ$

II. $H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(\ell)} \qquad \Delta H^0_{II} = -286.0\ kJ$

III. $4C_{(s)} + 4H_{2(g)} + O_{2(g)} \longrightarrow C_3H_7COOH_{(\ell)} \qquad \Delta H^0_{III} = -534.0\ kJ$

Use this information to calculate the value of $\Delta H^0_{(1)}$. Provide detailed calculations.

ה. Reaction (2), below, was run in the lab:

(2) $C_3H_7COOH_{(g)} + 5O_{2(g)} \longrightarrow 4CO_{2(g)} + 4H_2O_{(g)} \qquad \Delta H^0_{(2)} = -2{,}065.6\ kJ$

The following table shows values of bond enthalpies.

Bond	**O–H** (in H_2O molecules)	**C=O** (in CO_2 molecules)
Bond enthalpy $(\frac{kJ}{mol})$	463	803

Calculate the amount of energy required to break down all the covalent bonds in the reactants when reacting 1 mole of $C_3H_7COOH_{(g)}$. Provide detailed calculations.

/continued on page 12/

Stoichiometry

12. The metal magnesium, $Mg_{(s)}$, is used mainly in the car and aviation industries. Usually, these industries use alloys of aluminum, $A\ell_{(s)}$, with magnesium, $Mg_{(s)}$. However, sometimes minuscule amounts of other metals such as titanium, $Ti_{(s)}$, are added to the alloy (the atomic number of titanium is 22).

א. There is 0.1 gram of $Ti_{(s)}$ in 1 kg of one of the magnesium alloys.
Calculate how many atoms of Ti are in 1 kg of this alloy. Provide detailed calculations.
Given: There are $6.02 \cdot 10^{23}$ particles in one mole of particles.

Late in the 20th century, a plant for extracting the metal $Mg_{(s)}$ was established in Sedom to utilize the high concentration of magnesium ions, $Mg^{2+}_{(aq)}$, present in Dead Sea water.

ב. The concentration of $Mg^{2+}_{(aq)}$ ions in Dead Sea water is 39.2 grams per liter.
Calculate the molar concentration of $Mg^{2+}_{(aq)}$ ions in Dead Sea water.
Provide detailed calculations.

ג. Carnallite is the name of a mixture harvested from Dead Sea water. One of its components is magnesium chloride, $MgC\ell_{2(s)}$.
One step in the process of extracting the $Mg_{(s)}$ involves melting the carnallite at a temperature of 700°C and passing an electric current through it.
Under these conditions, Reaction (1) occurs:

$$(1)\quad Mg^{2+}_{(\ell)} + 2C\ell^{-}_{(\ell)} \xrightarrow{\text{electric current}} Mg_{(s)} + C\ell_{2(g)}$$

i Explain why it is necessary to melt carnallite before an electric current is passed through it.

ii Calculate the volume of the gas $C\ell_{2(g)}$ obtained in the production of 1 ton of $Mg_{(s)}$.
Provide detailed calculations.
Given: There are 1,000,000 grams (1×10^6 grams) in 1 ton.
Under the conditions of this reaction, the volume of 1 mole of gas is 80 liters.

/continued on page 13/

ד. Some of the $C\ell_{2(g)}$ produced in the magnesium plant is used to produce bromine, $Br_{2(\ell)}$. $C\ell_{2(g)}$ gas is fed into a solution containing bromine ions, $Br^-_{(aq)}$.
Reaction (2) occurs.

(2) $C\ell_{2(g)} + 2Br^-_{(aq)} \longrightarrow Br_{2(\ell)} + 2C\ell^-_{(aq)}$

The concentration of $Br^-_{(aq)}$ ions in the solution used to produce $Br_{2(\ell)}$ is 0.125M.
Calculate the volume of solution required to produce 1000 moles of $Br_{2(\ell)}$.
Provide detailed calculations.

ה. An experiment to produce bromine according to Reaction (2) was conducted in a lab. The gas $C\ell_{2(g)}$ was fed into a 100 ml solution of $Br^-_{(aq)}$ ions with a concentration of 0.5M. The substances reacted completely.

i Calculate the mass of $Br_{2(\ell)}$ obtained. Provide detailed calculations.

ii Calculate the volume of the gas $C\ell_{2(g)}$ that reacted. Provide detailed calculations.
Given: Under the conditions of this experiment, the volume of 1 mole of gas is 25 liters.

/continued on page 14/

Oxidation-Reduction

13. This question relates to the relative ability of metals to reduce, and the relative ability of aqueous ions to oxidize.

Below is a list of aqueous ions:

$Cu^{2+}_{(aq)}$, $Ag^{+}_{(aq)}$, $Fe^{2+}_{(aq)}$, $Zn^{2+}_{(aq)}$

א. A lab experiment was conducted in two steps.

In the first step a copper, $Cu_{(s)}$, strip was dipped in a beaker with a colorless solution of silver nitrate, $AgNO_{3(aq)}$. In the resulting reaction all the silver ions, $Ag^{+}_{(aq)}$, reacted. The color of the solution changed to pale blue and a gray precipitate formed at the bottom of the beaker.

i Write a net balanced equation for the reaction that took place in the first step of the experiment.

In the second step, when the reaction in the first step was complete, the gray precipitate was separated from the solution.

Next, a strip of zinc, $Zn_{(s)}$, was dipped in the solution. A reaction occurred.

A colorless solution and a reddish-brown precipitate were obtained.

ii Write a net balanced equation for the reaction that took place in the second step of the experiment.

iii Arrange the metals copper, $Cu_{(s)}$, silver, $Ag_{(s)}$, and zinc, $Zn_{(s)}$, in decreasing order of their relative ability to reduce.

Explain your answer based on the results from both steps of the experiment.

/continued on page 15/

ב. Metals exposed to the environment sometimes become corroded. Protective measures are taken to prevent this corrosion.

i To prevent corrosion, iron, $Fe_{(s)}$, pipes that will be installed underground are coated with zinc, $Zn_{(s)}$.

Coating iron pipes with copper, $Cu_{(s)}$, does not prevent corrosion of the iron.

Determine which metal, $Cu_{(s)}$ or $Zn_{(s)}$ is a better reducer than $Fe_{(s)}$.

Explain your answer.

ii The Statue of Liberty in New York is built of iron pillars with copper plates attached to them.

Corrosion has developed at the points of contact between the iron pillars and the copper plates.

Explain why there is corrosion at these contact points.

ג. Arrange the ions $Zn^{2+}_{(aq)}$, $Ag^{+}_{(aq)}$, $Cu^{2+}_{(aq)}$, $Fe^{2+}_{(aq)}$ in decreasing order of their relative ability to oxidize. Base your answer on the information in Items א and ב.

ד. Hydronium ions, $H_3O^{+}_{(aq)}$, can react as oxidizers.

When a strip of $Fe_{(s)}$ is dipped in a solution of hydrochloric acid, $HC\ell_{(aq)}$, Reaction (1) occurs:

(1) $Fe_{(s)} + 2H_3O^{+}_{(aq)} \longrightarrow Fe^{2+}_{(aq)} + H_{2(g)} + 2H_2O_{(\ell)}$

Determine which of the ions, $H_3O^{+}_{(aq)}$ or $Fe^{2+}_{(aq)}$ is a better oxidizer. Explain.

/continued on page 16/

Acids and Bases, and Stoichiometry

14. There are 500 ml of water, $H_2O_{(\ell)}$, in each of the two containers A and B.

100 ml of the gas hydrogen bromide, $HBr_{(g)}$, were fed into Container A.

100 ml of the gas ammonia, $NH_{3(g)}$, were fed into Container B.

א. i Formulate the reaction that occurred in Container A and the reaction that occurred in container B.

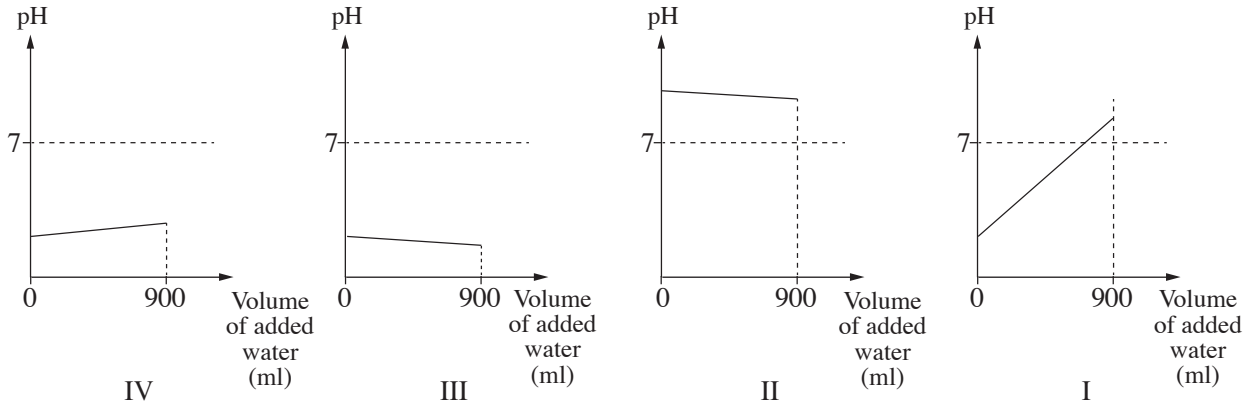
ii Determine whether the pH of the solution in each of the containers (A and B) when the reaction was complete was greater than, smaller than, or equal to 7. Explain.

iii Calculate the molar concentration of the solution obtained in Container A.
Provide detailed calculations.

Given: Under the conditions of this reaction, the volume of 1 mole of gas is 25 liters.

ב. 900 ml of water were gradually added to 100 ml of the solution in Container A, and the pH of the solution was measured.

Determine which of the graphs I-IV below correctly describes the change in pH of the solution as the water was added. Explain.



/continued on page 17/

ג. 100 ml of the solution from Container A were mixed with 20 ml of a potassium hydroxide solution, $KOH_{(aq)}$. A reaction occurred. When the reaction was complete, the pH of the solution was 7.

i Formulate the net reaction that occurred.

ii Calculate the molar concentration of the $KOH_{(aq)}$ solution.
Provide detailed calculations and explain.

ד. When the gas $HBr_{(g)}$ comes in contact with the gas $NH_{3(g)}$, the following reaction occurs:

$$HBr_{(g)} + NH_{3(g)} \longrightarrow NH_4Br_{(s)}$$

The solid ammonium bromide, $NH_4Br_{(s)}$, which is formed in this reaction, dissolves well in water.

Determine whether each of the statements i and ii, below, is true or false.
Explain your answer in each case.

i The reaction between $HBr_{(g)}$ and $NH_{3(g)}$ is an acid-base reaction.

ii The aqueous solution of $NH_4Br_{(aq)}$ is electroconductive.

Good Luck!