PSC- 4012 Review For Exam

1. Which of the following five statements accurately describes the current simplified atomic model? (3 marks)

a) Neutrons are positive, while electrons are negative. (NEUTRONS ARE NEUTRAL!)
b) The total volume of the nucleus is very small compared to the total volume of the atom.
c) Electrons revolve within well-defined energy levels arranged around the nucleus.
d) The mass of an electron is 1840 times greater than that of a neutron. (ELECTRONS ARE 1840 TIMES SMALLER!
e) Neutrons are particles that help keep the nucleus together.

Answers: B, C, E

1. Which of the following five statements accurately describes the current simplified atomic model? (3 marks)

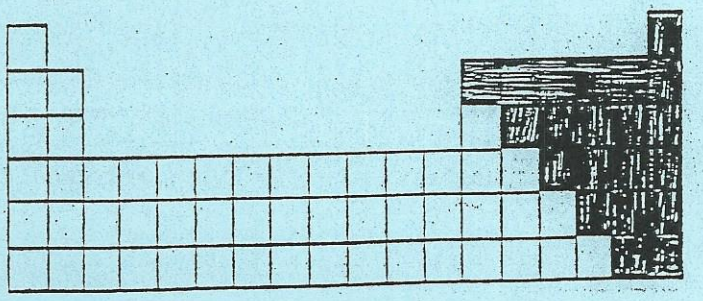
a) The mass of a proton is 1840 times greater than that of an electron.
b) The ratio of the mass of a proton to that of a neutron is 1.
c) The maximum number of electrons in the 1st three energy levels are: 2,8, and 16 respectively. (2, 8 AND 18!)
d) Protons travel within well-defined zones called energy levels. (ELECTRONS ARE ON LEVELS
e) The nucleus contains protons and neutrons with opposite charges that neutralize each other. (NOT OPPOSITE CHARGES: PROTONS ARE POSITIVE NEUTRONS ARE NEUTRAL)

Answers: A, B

2. Which of the following five statements pertain to metals? (3 marks)

a) They are dull. (NON-METALS LOOK DULL)
b) They are malleable.
c) They are all solids at room temperature. (NOT MERCURY (Hg)!)
d) They do not conduct electricity. (METALS DO!)
e) Their position is given in grey in the following periodic table. (METALS ARE ON THE LEFT OF THE DARK STAIRCASE LINE).

Answers: B



Which of the following five statements are true? (3 marks)

a) Metals are ductile.
b) The alkali metals react strongly with oxygen and halogens.
c) Metalloids have properties of metals and nonmetals.
d) Nonmetals are poor electrical conductors.
e) Hydrogen belongs to the family of alkali metals. (HYDROGEN IS IN A FAMILY OF ITS OWN!)

Answers: A, B, C, D

3. Complete the following table, giving, where possible, the electron configuration, family name or period number of each element. If necessary, refer to the attached periodic table. (4 marks)

Cl = 17e⁻
P = 15e⁻
Ne = 10e⁻
Ar = 18e⁻
Si = 14e⁻
Na = 11e⁻
N = 7e⁻
Ca = 20e⁻
Li = 3e⁻
O = 8e⁻
Mg = 12e⁻
Al = 13e⁻
Ar = 18e⁻

Electron configuration of the element	Family name	Period number
2e⁻, 8e⁻, 7e⁻	Halogen	3
2e⁻, 8e⁻, 5e⁻	FAMILY OF Nitrogen	3
2e 8e	NOBLE, INERT, RARE GASES	2
2e 8e 8e	NOBLE, INERT, RARE GASES	3
2e 8e 4e	FAMILY OF CARBON	3
2e⁻, 8e⁻, 1e⁻	Alkali metal	3
2e 5e	FAMILY OF NITROGEN	2
2e 8e 8e 2e	ALKALINE-EARTH METALS	4
2e⁻, 1e⁻	Alkali metal	2
2e⁻, 6e⁻	FAMILY OF Oxygen	2
2e 8e 2e	ALKALINE-EARTH METALS	3
2e 8e 3e	FAMILY OF BORON	3
2e⁻, 8e⁻, 8e⁻	Noble gas	3

4. a) Use the periodic table attached to find the silicon (Si) isotopes among the elements listed below. (2 marks) A, C, F (ALL HAVE 14 PROTONS)

Elements	Number of protons	Number of neutrons	Number of electrons
A	14	14	15
B	13	12	13
C	14	13	14
D	15	14	16
E	13	13	12
F	14	15	13

b) Indicate whether the six elements above are neutral atoms, anions or cations by placing their corresponding letters in the appropriate boxes. (2 marks)

Neutral Atoms	Anions	Cations
B, C	A⁻, D⁻	E⁺, F⁺
(SAME NUMBER OF [illegible])	(MORE ELECTRONS THAN PROTONS)	(MORE PROTONS THAN ELECTRONS)

4. a) Use the periodic table attached to find the sulphur (S) isotopes among the elements listed below. (2 marks) A, E, F (ALL HAVE 16 PROTONS)

Elements	Number of protons	Number of neutrons	Number of electrons
A	16	15	16
B	15	15	16
C	14	15	13
D	17	17	17
E	16	16	17
F	16	17	15

c) Indicate whether the six elements above are neutral atoms, anions or cations by placing their corresponding letters in the appropriate boxes. (2 marks)

Neutral Atoms	Anions	Cations
A, D	B^-, E^-	C^+, F^+

(SAME NUMBER OF POSITIVE PROTONS AND NEGATIVE ELECTRONS)

(MORE NEGATIVE ELECTRONS THAN POSITIVE PROTONS)

(MORE POSITIVE PROTONS THAN NEGATIVE ELECTRONS)

5. (4 marks) Give the chemical formula for the binary compounds formed by the combination of hypothetical elements P, Q, R, and S. The family number of each element is given below:

Element P: family IA (GIVER OF ONE: ①)
Element Q: family IIA (GIVER OF TWO: ②)
Element R: family IVA (GIVER OR TAKER OF FOUR: ④)
Element S: family VA (TAKER OF THREE: ③)

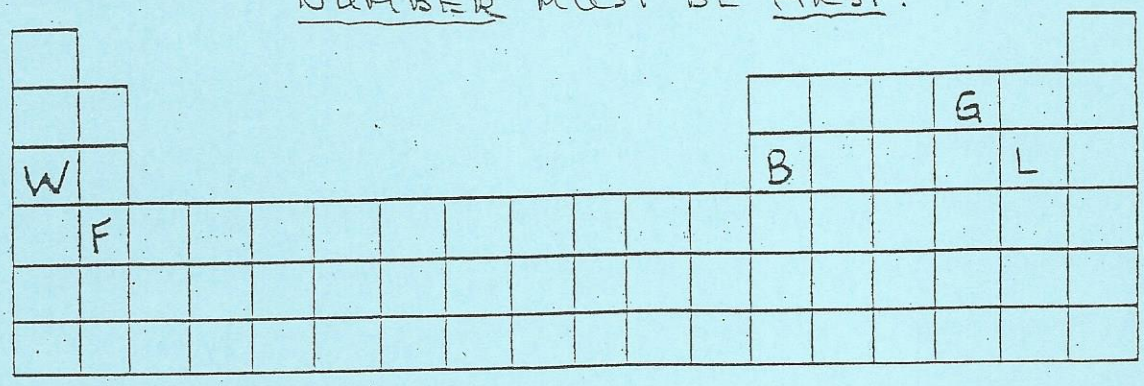
※ USING THE CROSS-OVER RULE:

Answers:

Compound formed by P and S	Compound formed by P and R
P_3S ① ↔ ③	P_4R ① ↔ ④
Compound formed by Q and S	**Compound formed by Q and R**
Q_3S_2 ② ↔ ③	Q_2R ② ④ ① ② REDUCE!!

5. (4 marks) Give the chemical formula for the binary compounds formed by the combination of hypothetical elements W, F, B, G, and L. The positions of these elements in the periodic table are given below:

※ REMEMBER: THE ELEMENT WITH THE LOWEST GROUP NUMBER MUST BE FIRST!



W: GIVER OF ONE: ①
F: GIVER OF TWO: ②
B: GIVER OF THREE: ③
G: TAKER OF TWO: ②
L: TAKER OF ONE: ①

Answers:

Compound formed by B and G	Compound formed by W and L
B_2G_3 ③ ↔ ②	WL ① ① SAME NUMBER = ONE OF EACH.
Compound formed by F and G	**Compound formed by B and L**
FG ② ② SAME NUMBER = ONE OF EACH.	BL_3 ③ ↔ ①

6.(4 marks) Match each of the substances in the table below with the appropriate category of a substance. Fill in the table, writing the letter for each category next to the substance it describes.

Categories:
A - Solution
B – Element
C – Suspension
D – Solid mixture
E – Compound

Substance	Category
Brass ring (ALLOY)	D
Table salt	E
Aluminum wire	B
Dairy Queen Smarties Blizzard	D
Ocean water (IF CLEAN)	A
Dirt	D
Vinegar	A
White gold bracelet (ALLOY)	A
V8 juice	C

7. Complete the following table, giving either the name or the chemical formula of the compound. The names of the polyatomic ions are given in Appendix. (4 marks)

RULE #1 AND #3. RULE #2. (GROUPS)

Chemical formula	Name according to the new nomenclature	Name according to the traditional nomenclature
AsF_5	ARSENIC PENTAFLUORIDE	_____
Ba_3N_2	Barium nitride	_____
K_2SO_4	_____	POTASSIUM SULFATE
Cs_2CrO_4	_____	CESIUM CHROMATE
$AlPO_4$	_____	Aluminum phosphate
CCl_4	Carbon tetrachloride	_____
$NaCH_3COO$	_____	Sodium acetate
Cr_2S_3	CHROMIUM (III) SULFIDE	_____

8. Indicate whether, according to the theory of Arrhenius, each of the [illegible] below is an acid, a base, or a salt. Explain your answer. (4 marks)

a) BaI_2: SALT

STARTS WITH A METAL, ENDS WITH A NON-METAL

b) H_3BO_3: ACID

STARTS WITH HYDROGEN (H), ENDS WITH NON-METALS

c) $Ca(OH)_2$: BASE

STARTS WITH A METAL, ENDS WITH GROUP HYDROXIDE (OH)

d) SrO: SALT

STARTS WITH METAL, ENDS WITH NON-METAL

e) H_2SO_4: ACID

STARTS WITH HYDROGEN (H), ENDS WITH NON-METALS

f) PBr_5: NOT A SALT, NOT AN ACID, NOT A BASE!!

TWO NON-METALS TOGETHER!

g) Fe_2O_3: SALT

STARTS WITH METAL, ENDS WITH NON-METAL

h) LiOH: BASE

STARTS WITH A METAL, ENDS WITH GROUP HYDROXIDE (OH)

9. A student conducted laboratory tests using litmus paper and an electrical conductivity detector. The following table shows the results for the five liquids tested:

(4 marks)

	LIQUIDS				
TESTS	A	B	C	D	E
Conducts current	No	+++	+++	+++	+
Red litmus paper turns/remains	Red	Red	Red	Blue	Red
Blue litmus paper turns/remains	Blue	Blue	Red	Blue	Red

On the basis of these results, indicate:

a) Which liquid is a solution of base and a strong electrolyte? D (BLUE-BLUE-YES; +++)

b) Which liquid is a solution of acid and a strong electrolyte? C (RED-RED-YES; +++)

c) Which liquid is a non–electrolyte solution? A (RED-BLUE-NO)

d) Which liquid is a solution of acid and a weak electrolyte? E (RED-RED-YES; +)

e) Which liquid is a neutral salt solution? B (RED-BLUE-YES; +++)

9. (4 marks) A student conducted laboratory tests using litmus paper and an electrical conductivity detector. The following table shows the results for the five liquids tested:

	LIQUIDS				
TESTS	A	B	C	D	E
Conducts current	+++	No	+++	+	+++
Red litmus paper turns/remains	Red	Red	Blue	Red	Red
Blue litmus paper turns/remains	Red	Blue	Blue	Red	Blue

On the basis of these results, indicate:

a) Which liquids are solutions of strong electrolytes? A, C, E

b) Which liquids are solutions of weak electrolytes? D

c) Which liquid is a salt solution? E (RED-BLUE-YES)

d) Which liquid could be distilled water? B (RED-BLUE-NO)

10. List the following substances in ascending order of acidity – in other words, from the least acidic to the most acidic. (4 marks)

a) Nitric acid at $1x10^{-1}$ mol/L. (pH = 1)
b) Vinegar has a pH of 3.
c) Water is neutral. (pH = 7)
d) Drano has a H^+ concentration of $1x10^{-13}$. (pH = 13)

Answer: D, C, B, A

10. List the following substances in ascending order of acidity – in other words, from the least acidic to the most acidic. (4 marks)

a) Tums have a pH of 10.8.
b) Rainwater has a pH of 5.7.
c) The H^+ concentration of lemon juice is $1x10^{-3}$. (pH = 3)
d) Barium hydroxide has a H^+ concentration of $1x10^{-14}$ mol/L. (pH = 14)

Answer: D, A, B, C

10. List the following substances in ascending order of acidity – in other words, from the least acidic to the most acidic. (4 marks)

a) An orange has a H^+ concentration of $1x10^{-3}$ mol/L (pH = 3)
b) Maalox has a pH of 11.5.
c) Milk is almost neutral. (pH ≅ 7)
d) An unidentified solution has a H^+ concentration of $1x10^{-6}$ mol/L. (pH = 6)

Answer: B, C, D, A

10. List the following substances in ascending order of acidity – in other words, from the least acidic to the most acidic. (4 marks)

a) Blood (pH = 7.4)
b) Hydrochloric acid with a (pH = 0)
c) Pure water (pH = 7)
d) Tears (pH = 7.2)
e) Grapes: concentration of $H^+ = 1x10^{-3}$ M (pH = 3)
f) Oven cleaner: concentration of $H^+ = 1x10^{-13}$M (pH = 13)
g) Urine: concentration of pH = 1×10^{-5} mol/L (pH = 5)

Answer: F, A, D, C, G, E, B

11. Copper (II) nitrate ($Cu(NO_3)_2$) decomposes to produce CuO, NO_2, and O_2. Write the balanced equation that represents this decomposition reaction. Show all steps.

(4 marks)

$$1\ Cu(NO_3)_2 \longrightarrow 1\ CuO + 2\ NO_2 + 0{,}5\ O_2$$

OR

$$2\ Cu(NO_3)_2 \longrightarrow 2\ CuO + 4\ NO_2 + 1\ O_2$$

11. When propane (C_3H_8) is combined with oxygen (O_2), it produces carbon dioxide (CO_2) and steam (H_2O). Write the balanced equation that shows this combustion. Show all steps.

(4 marks)

$$1\ C_3H_8 + 5\ O_2 \longrightarrow 3\ CO_2 + 4\ H_2O$$

11. When iron combines with oxygen gas (O_2) and water, iron (III) hydroxide ($Fe(OH)_3$) is often produced. Write the balanced equation for this reaction, which shows the production of rust. Show all steps.

(4 marks)

$$2\ Fe + 1{,}5\ O_2 + 3\ H_2O \longrightarrow 2\ Fe(OH)_3$$

OR

$$4\ Fe + 3\ O_2 + 6\ H_2O \longrightarrow 4\ Fe(OH)_3$$

11. When ammonia gas (NH_3) is burned in the presence of oxygen(O_2), the following products result: NO_2 and H_2O. Write the balanced chemical equation for this reaction. Show all steps.

(4 marks)

$$2\ NH_3 + 3{,}5\ O_2 \longrightarrow 2\ NO_2 + 3\ H_2O$$

OR

$$4\ NH_3 + 7\ O_2 \longrightarrow 4\ NO_2 + 6\ H_2O$$

11. When iron pyrite (FeS_2) is combined with oxygen (O_2), it produces Fe_2SO_3 and SO_2. Write the balanced equation that represents this combustion.

(4 marks)

$$2\ FeS_2 + 4{,}5\ O_2 \longrightarrow 1\ Fe_2SO_3 + 3\ SO_2$$

(OR)

$$4\ FeS_2 + 9\ O_2 \longrightarrow 2\ Fe_2SO_3 + 6\ SO_2$$

11. When C_2H_2 is burned with oxygen (O_2), it gives CO_2 and water (H_2O). Write the balanced equation that represents this combustion.

(4 marks)

$$1\ C_2H_2 + 2{,}5\ O_2 \longrightarrow 2\ CO_2 + 1\ H_2O$$

(OR)

$$2\ C_2H_2 + 5\ O_2 \longrightarrow 4\ CO_2 + 2\ H_2O$$

11. When phosphorous (P_4) is burned with oxygen (O_2), a gaseous phosphorous oxide (P_2O_5) is produced. Write the balanced equation that represents this combustion.

(4 marks)

$$1\ P_4 + 5\ O_2 \longrightarrow 2\ P_2O_5$$

11. When glucose ($C_6H_{12}O_6$) is burned in the body, it reacts with oxygen (O_2) to produce carbon dioxide (CO_2) and water (H_2O). Write the balanced equation that represents this combustion reaction.

(4 marks)

$$1\ C_6H_{12}O_6 + 6\ O_2 \longrightarrow 6\ CO_2 + 6\ H_2O$$

12. Na and Cl

a) What type of chemical bond exists between these two elements?

IONIC BOND

b) Explain what led you to this conclusion.

THE DIFFERENCE OF ELECTRONEGATIVITY IS 1,7 OR MORE : Cl = 3,0 } 3,0 − 0,9 = 2,1
Na = 0,9

c) Give the Lewis diagram for each of these elements.

Na × (GIVE ONE)

·Cl: (TAKE ONE)

d) Give the Lewis diagram of the compound formed by these two elements, as well as its structural formula representation, if applicable.

Na⁺ [×Cl:]⁻

FORMULA : NaCl

STRUCTURAL FORMULA : Na—Cl

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12. N and F are two elements. (8 marks)

a) What type of chemical bond exists between these two elements?

POLAR COVALENT

b) Explain what led you to this conclusion.

THE DIFFERENCE OF ELECTRONEGATIVITY IS BETWEEN 0,5 AND 1,6 : N = 3,0 } 4,0 − 3,0 = 1,0
F = 4,0

c) Give the Lewis diagram for each of these elements.

:N· (SHARE 3)

×F× (SHARE 1)

d) Give the Lewis diagram of the compound formed by these two elements, as well as its structural formula representation, if applicable.

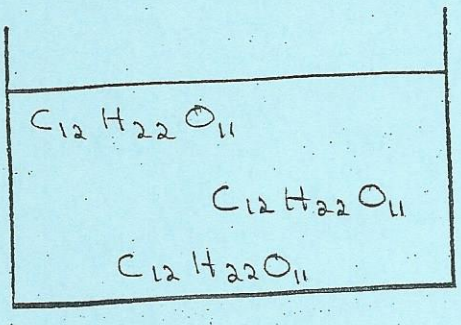
FORMULA : NF_3

STRUCTURAL FORMULA :

F
|
F—N—F

13. A sugar solution does not conduct electricity. (4 marks)

a) Illustrate, in the vessel shown below, what happens when sucrose ($C_{12}H_{22}O_{11}$) is dissolved in an aqueous solution.



b) What type of dissolution takes place?

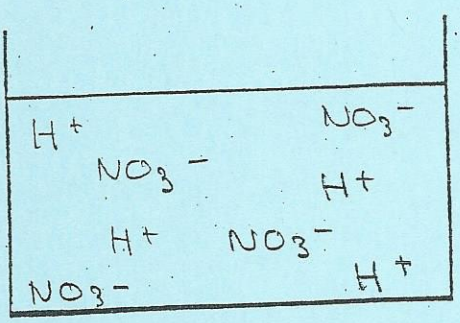
MOLECULAR DISSOLUTION.

c) Explain your answer:

THE MOLECULES ARE PRESERVED, THE SUCROSE DOES NOT "SPLIT" INTO IONS. SO, THE SUGAR SOLUTION CANNOT CONDUCT ELECTRICITY.

13. A nitric acid solution (HNO_3) is a good conductor of electricity. (4 marks)

a) Illustrate, in the vessel shown below, what happens when this acid is dissolved in an aqueous solution.



b) What type of dissolution takes place?

IONIC DISSOLUTION

c) Explain your answer:

SINCE ALL ACIDS ARE ELECTROLYTES, THE NITRIC ACID WILL SPLIT INTO IONS WHEN DISSOLVED IN WATER.

1 x Ba = 1 x 137,327 = 137,327
2 x N = 2 x 14,007 = 28,014 (+)
6 x O = 6 x 15,999 = 95,994
261,335 grams

14. Given the following three solutions:

Solution A: 9 mol of $Ba(NO_3)_2$ in 4 L of solution
Solution B: 0.18 mol of $Ba(NO_3)_2$ in 79.6 mL of solution
Solution C: 24 g of $Ba(NO_3)_2$ in 55 mL of solution

Which solution has the highest concentration of $Ba(NO_3)_2$? Your answer must include the formula or formulas used and all of the calculations, including a clear indication of the units of measure.

(6 marks)

SINCE 1 MOL OF $Ba(NO_3)_2$ = 261,335 grams.

$n_A = 9$ moles
$m_A = 2352,015$ g
$V_A = 4$ L
$C_A = \frac{m_A}{V_A} = \frac{2352,015\text{ g}}{4\text{ L}}$
$C_A = 588,00$ g/L

$n_B = 0,18$ mol
$m_B = 47,0403$ g
$V_B = 79,6\text{ mL} = 0,0796$ L
$C_B = \frac{m_B}{V_B} = \frac{47,0403\text{ g}}{0,0796\text{ L}}$
$C_B = 590,96$ g/L

$m_C = 24$ g
$V_C = 55\text{ mL} = 0,055$ L
$C_C = \frac{24\text{ g}}{0,055\text{ L}}$
$C_C = 436,36$ g/L

ANS.: SOLUTION B HAS THE HIGHEST CONCENTRATION

14. Given the following three solutions:

Solution A: 3 g of $AlCl_3$ in 150 mL of solution
Solution B: 3 mol of $AlCl_3$ in 15 L of solution
Solution C: 15 g of $AlCl_3$ in 1.2 L of solution

1 x Al = 1 x 26,982 = 26,982
3 x Cl = 3 x 35,453 = 106,359 (+)
133,341 gr.

Which solution has the highest concentration of $AlCl_3$? Show all work.

(6 marks)

SINCE 1 MOLE OF $AlCl_3$ = 133,341 grams

$m_A = 3$ grams
$V_A = 150\text{ mL} = 0,150$ L
$C_A = \frac{m_A}{V_A} = \frac{3\text{ g}}{0,150\text{ L}}$
$C_A = 20$ g/L

$n_B = 3$ moles
$m_B = 400,023$ g.
$V_B = 15$ L
$C_B = \frac{m_B}{V_B} = \frac{400,023\text{ g}}{15\text{ L}}$
$C_B = 26,67$ g/L

$m_C = 15$ g
$V_C = 1,2$ L
$C_C = \frac{m_C}{V_C} = \frac{15\text{ g}}{1,2\text{ L}}$
$C_C = 12,5$ g/L

ANS.: SOLUTION B HAS THE HIGHEST CONCENTRATION.

1 x Na = 1 x 22,989 = 22,989
1 x N = 1 x 14,007 = 14,007
3 x O = 3 x 15,999 = 47,997

84,993 grams

14. Given the following three solutions:

Solution A: 50 g $NaNO_3$ in 0.5 L of solution
Solution B: 0.1 mol $NaNO_3$ in 100 mL of solution
Solution C: 0.18 kg $NaNO_3$ in 1 L of solution

Which solution has the highest concentration of $NaNO_3$? Show all work. (6 marks)

SINCE 1 MOLE OF $NaNO_3$ = 84,993 grams

$m_A = 50\ g$
$V_A = 0,5\ L$
$C_A = \frac{m_A}{V_A} = \frac{50\ g}{0.5\ L}$
$C_A = 100\ g/L$

$n_B = 0,1$ mole
$m_B = 8,4993$ grams
$V_B = 100\ mL = 0,1\ L$
$C_B = \frac{m_B}{V_B} = \frac{8,4993\ g}{0,1\ L}$
$C_B = 84,993\ g/L$

$m_C = 0,18\ kg$
$m_C = 180$ grams
$V_C = 1\ L$
$C_C = \frac{m_C}{V_C} = \frac{180\ g}{1\ L}$
$C_C = 180\ g/L$

ANS: SOLUTION C HAS THE HIGHEST CONCENTRATION

15. A chemist decides that he wants to prepare ten 250 mL jars of fertilizer. Unfortunately, he has no diluted nitric acid. He decides to prepare some diluted nitric acid by using a concentrated (18 M) solution of nitric acid (HNO_3). He uses 750 mL of this, then adds water until he obtains 5 L.

What is the concentration of the diluted solution of nitric acid? Your answer must include the formula or formulas used and all of the calculations, including a clear indication of the units of measure. (4 marks)

FORMULA: $C_1 \cdot V_1 = C_2 \cdot V_2$

$C_1 = 18\ mol/L$
$V_1 = 750\ mL = 0,75\ L$
$C_2 = ??$
$V_2 = 5\ L$

$18 \cdot 0,75 = C_2 \cdot 5$
$13,5 = 5 \cdot C_2$
$\frac{13.5}{5} = \frac{5 C_2}{5}$

$C_2 = 2,7\ mol/L$

15. A housekeeper wants to use an ammonia solution. The concentration of ammonia (NH_4OH) in a 500 mL bottle is 14 mol/L. The housekeeper needs a solution whose concentration of ammonia is 0.2 mol/L, using a spray bottle with a capacity of 12 litres. How much undiluted ammonia should she put in her spray bottle? Your answer must include the formula or formulas used and all of the calculations, including a clear indication of the units of measure. (4 marks)

FORMULA: $C_1 \cdot V_1 = C_2 \cdot V_2$

$C_1 = 14$ mol/L

$V_1 = ??$

$C_2 = 0,2$ mol/L

$V_2 = 12$ L

$14 \cdot V_1 = 0,2 \cdot 12$

$14 \cdot V_1 = 2,4$

$\frac{14 V_1}{14} = \frac{2,4}{14}$

$V_1 = 0,17$ L

16. A red solution is always obtained when [illegible] solution. The solution remains colorless when indicator D is added to it. Use the information in the following table to determine the pH range of this solution.

Indicators	Change of color	Turning point
A	Red -> Yellow	From 3.0 to 4.4
B	Red -> Blue	From 5.2 to 8.0
C	Clear -> Red	From 0.2 to 2.0
D	Colorless -> Fuchsia	From 8.2 to 10.0

Include all the steps in your answer. (4 marks)

INDICATOR A = RED ? ⇒ 0 TO 3,0

INDICATOR B = RED ? ⇒ 0 TO 5,2

INDICATOR C = RED ? ⇒ 2,0 TO 14

INDICATOR D = COLORLESS ? ⇒ 0 TO 8,2

ANS.: (ALL TOGETHER) pH RANGE = 2,0 TO 3,0

16. A blue solution is always obtained when M, N, or O is added to an unidentified solution. The solution is red when indicator P is added to it.

Use the information in the following table to determine the pH range of this solution.

Indicators	Change of color	Turning point
M	Yellow -> blue	From 3.8 to 5.4
N	Red -> blue	From 5.2 to 8.0
O	Blue -> yellow	From 12.0 to 14.0
P	Yellow -> red	From 6.4 to 8.2

Include all the steps in your answer. (4 marks)

INDICATOR M = BLUE ? ⇒ 5,4 TO 14

INDICATOR N = BLUE ? ⇒ 8,0 TO 14

INDICATOR O = BLUE ? ⇒ 0 TO 12,0

INDICATOR P = RED ? ⇒ 8,2 TO 14

ANS.: (ALL TOGETHER) pH RANGE = 8,2 TO 12

16. A yellow solution is obtained when indicator A or B is added to an unidentified solution. The solution is blue when indicator C or D is added to it. Use the information in the following table to determine the pH range of this solution.

Indicators	Change of color	Turning Point
A	From yellow to blue	From 3.8 to 5.4
B	From yellow to violet	From 7.6 to 9.2
C	From blue to red	From 2.7 to 5.7
D	From blue to colorless	From 4.5 to 9.0

Include all the steps in your answer. (4 marks)

INDICATOR A = YELLOW ? ⇒ 0 TO 3,8
INDICATOR B = YELLOW ? ⇒ 0 TO 7,6
INDICATOR C = BLUE ? ⇒ 0 TO 2,7
INDICATOR D = BLUE ? ⇒ 0 TO 4,5

ANS.: (ALL TOGETHER), pH RANGE = 0 TO 2,7

16. A violet solution is obtained when indicator H or J is added to an unidentified solution. A red solution is obtained when indicator I or K is added to the solution. Use the information in the following table to determine the pH range of this solution.

Indicators	Change of color	Turning Point
H	Yellow to violet	From 3.0 to 4.6
I	Yellow to red	From 10.1 to 11.1
J	Yellow to violet	From 5.2 to 6.8
K	Yellow to red	From 6.4 to 8.2

Include all the steps in your answer. (4 marks)

INDICATOR H = VIOLET ? ⇒ 4,6 TO 14
INDICATOR I = RED ? ⇒ 11,1 TO 14
INDICATOR J = VIOLET ? ⇒ 6,8 TO 14
INDICATOR K = RED ? ⇒ 8,2 TO 14

ANS.: (ALL TOGETHER), pH RANGE = 11,1 TO 14

17. By burning 0.73g of sucrose ($C_{12}H_{22}O_{11}$), the human body obtains energy for a minute. The combustion of this quantity of sugar is expressed by the following chemical equation:

X1 X12 X12 X11

$$C_{12}H_{22}O_{11} + O_2 \rightarrow CO_2 + H_2O$$

Two astronauts burn 15 903 grams of sucrose during a 7.5 day flight on a space shuttle. How many moles of oxygen are needed to burn this much sucrose? Your answer must include the formula or formulas used and all of the calculations, including a clear indication of the units of measure. (4 marks)

1) BALANCING THE EQUATION:

$$1\ C_{12}H_{22}O_{11} + 12\ O_2 \longrightarrow 12\ CO_2 + 11\ H_2O$$

2) MOLAR MASS OF SUCROSE:

$(12 \times 12,011\ (C)) + (22 \times 1,008\ (H)) + (11 \times 15,999\ (O))$

$= 144,132 + 22,176 + 175,989 = 342,297$ gr/mol

3) $n = \frac{m}{M} = \frac{15903 \text{ gr}}{342,297 \text{ gr/mol}}$

$n = 46,46$ moles

4) CROSS-MULTIPLICATION

$\frac{1}{46,46} = \frac{12}{x}$

$X = 557,52$ moles OF O_2

17. Sodium carbonate (Na_2CO_3) is a compound used in the manufacture of glass. Since very little of it is found in nature, it is manufactured using two very abundant components, calcium carbonate (marble) and sodium chloride. The transformation is expressed by the following chemical equation:

X1 X2 X1 X1

$$CaCO_3 + NaCl \rightarrow Na_2CO_3 + CaCl_2$$

How many grams of sodium chloride are required to form 4.5 mol of sodium carbonate (Na_2CO_3)?
Your answer must include the formula or formulas used and all of the calculations, including a clear indication of the units of measure. (4 marks)

1) BALANCING THE EQUATION:

$$1\ CaCO_3 + \underbrace{2\ NaCl}_{X \text{ mole}} \rightarrow \underbrace{1\ Na_2CO_3}_{4,5 \text{ moles}} + 1\ CaCl_2$$

2) CROSS-MULTIPLICATION:

$\frac{2}{x} = \frac{1}{4,5} \Rightarrow x = \frac{4,5 \times 2}{1} = 9$ moles OF NaCl

3) MOLAR MASS OF NaCl

$(1 \times 22,989\ (Na)) + (1 \times 35,453\ (Cl)) = 58,442$ gr./mol

4) mass $= n \times M = 9$ moles $\times 58,442$ gr./mol $= 525,978$ gr. OF NaCl

4

18. Sam spilled some drain cleaner (NaOH) on the floor. He decided to attempt to neutralize it before cleaning it up. To this end, he added some vinegar (CH_3COOH).

a) Write the equation for the reaction.

$NaOH + CH_3COOH \longrightarrow H_2O + NaCH_3COO$

b) Why does this reaction have a neutralizing effect?

A BASE USED IN THE RIGHT PROPORTION WILL NEUTRALISE AN ACID (AND VICE-VERSA) TO BECOME WATER AND SALT!

(4 marks)

$Mg(OH)_2$

18. TUMS contain calcium hydroxide ($Ca(OH)_2$). They are used to neutralize stomach acid (HCl). Use equations to explain how the antacid TUMS gives you relief from acid indigestion and heartburn.

THE BASE ($Ca(OH)_2$) WILL NEUTRALISE THE STOMACH ACID (HCl), ACCORDING TO THE EQUATIONS:

$2\,HCl + 1\,Ca(OH)_2 \longrightarrow 2\,H_2O + 1\,CaCl_2$

OR

ACID + BASE $\longrightarrow$ WATER + SALT.