Course Title	Math 1(a)	Academic Year 2021/2022 First- Semester Exam	Course Code	PME0101
Year/ Level	Preparatory Year			
Date	24 – 1 - 2022	No. of Pages (3)	Allowed time	3 hrs

Answer the following questions

Part (A)

Question Number (1) **(25 Points)**

a) Write the first four terms of the expansion of the function: **(6 marks)**

$f(x) = (4 + x)^{-3}$; $x \gg$. Find the condition of convergence of this expansion.

b) Consider the Chebychev polynomials defined by the relations **(7 marks)**
$T_0(x) = 1,\ T_1(x) = x,\ and\ T_{n+1}(x) = 2xT_n(x) - T_{n-1}(x)$. Use the extended mathematical induction principle to prove that:
$T_n(x) = \cos(n \cos^{-1} x)$.

c) Use the secant method to estimate the root of $f(x) = e^{-x} - x$. **(6 marks)**
Start with the initial values $x_0 = 0,\ x_1 = 1$. Two iterations are sufficient.

d) Find the eigenvalues and eigenvectors of the matrix $\begin{bmatrix} 1 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 1 \end{bmatrix}$. **(6 marks)**

Question Number (2) **(25 Points)**

2-a) Determinant whether or not the following set of vectors in R^3 are linearly dependent: $(1, -2, 1),\ (2, 1, -1),\ (7, -4, 1)$. **(6 marks)**

2-b) Analyse the fraction $\frac{4x^3+10x+4}{x(2x+1)}$ into its partial fractions. **(6 marks)**

2-c) Use the elementary matrices to put the matrix $A = \begin{pmatrix} 2 & 1 & 1 \\ 4 & 1 & 0 \\ -2 & 2 & 1 \end{pmatrix}$ in the form

$A = LU$. Then solve the system of equations $Ax = \begin{pmatrix} 1 \\ -2 \\ 7 \end{pmatrix}$. **(6 marks)**

2-d) If two roots of the equation $x^4 + 6x^3 + ax^2 + bx + 36 = 0$ are real and equal twice the other two roots. Solve the equation and evaluate a & b. **(7 marks)**

Part (B)

Question Number (1) Choose the correct answer: **(20 Points)**

(1) Suppose that $f(x) = lnx$ and $g(x) = 9 - x^2$. The domain 0f $f(g(x))$ is

(a) $|x| > 3$ (b) $|x| \leq 3$ (c) $x \leq 3$ (d) $|x| < 3$

(2) The inverse of the function $f(x) = log_3(x - 2)$, equal to:

(a) R/2 (b) $3^x - 2$ (c) $3^x + 2$ (d) $log_3(x - 2)^{-1}$

(3) If $9e^{3t} = 27$, then the value of t equal to :

(a) $\frac{ln27}{27}$ (b) $ln\sqrt[3]{3}$ (c) $ln3$ (d) 1

(4) Which of the following is an odd function

(a) $y = sinx$ (b) $y = x^3 + 1$ (c) $y = lnx$ (d) $y = cos^2x$

(5) The slope of the line normal to the curve $f(x) = 2\cos 4x$ at the point $x = \frac{\pi}{12}$ equal to:

(a) $\frac{\sqrt{3}}{12}$ (b) - 4 (c) $4\sqrt{3}$ (d) $\frac{1}{4}$

(6) Given the function $f(x) = e^{\frac{x}{2}}$ on the closed interval [1, 4]. If c is the number guaranteed by the mean value theorem, then c (corrected to three decimal places) is approximately

(a) 1.163 (b) 1.996 (c) 0.978 (d) 2.065

(7) The limit of the function $\lim_{x\to 0} \frac{cos3x-1}{x}$ equal to:

(a) 3 (b) -1 (c) 0 (d) 1

(8) The function $f(x) = x^3 - 2x^2$, is increasing on which of the following intervals:

(a) $x < 0$ only (b) $x > \frac{4}{3}$ only (c) $0 < x < \frac{4}{3}$ (d) $x < 0$ or $x > \frac{4}{3}$

(9) If $f(x) = x^3 lnx$ then $\frac{df}{dx}$ equal to:

(a) $x^2 lnx + x^2$ (b) $3x^2 lnx$ (c) $(3x^2 + 1)lnx$ (d) $(3lnx + 1)x^2$

(10) If $f(x) = \ln(lnx)$, then $(f)'(e)$ equal to:

(a) 0 (b) e (c) $\frac{1}{e}$ (d) 1

Question Number (2) **(30 Points)**

(1) If $y = e^{4x} + 2e^{-x}$ Prove that $y''' - 13y' - 12y = 0$ **(4 Points)**

(2) Evaluate the following limits:

(i) $\lim_{x\to\infty}(\frac{3x-4}{3x+2})^{\frac{x+1}{3}}$ (ii) $\lim_{x\to\frac{\pi}{4}}\frac{cosx-sinx}{\frac{\pi}{4}-x}$ (iii) $\lim_{x\to1}\left(\frac{x}{x-1}-\frac{1}{lnx}\right)$ **(6 Points)**

(3) Find y' when: **(10 Points)**

(i) $y = \sqrt{\tan\sqrt{x}} + x^{x^2} + 5^{sin^{-1}2x}$

(ii) $y = \sin\tanh\left(ln\sqrt{\frac{1+x}{1-x}}\right)$

(iii) $csh(x+y) + 5^{xy} = ln(x^y)$

(4) Prove that the function $f(x) = x^2 - 2x + 3$, $g(x) = x^3 - 7x^2 + 20x - 5$ satisfy the conditions of Cauchy theorem in the interval [1, 4] and find the corresponding value of c **(4 points)**

(5) Find the equations of the tangent and the normal lines and length of tangent, normal, under tangent and under normal for the curve $y = 4x^3 - 3xy^2 + 6x^2 - 5xy - 8y^2 + 9x + 14$ at the point (-2, 3). **(6 Points)**

End of questions..... With best wishes

Dr. A. E. Shalaby *Dr. F. R. Mousa*

Tanta University — Department: Computers and Automatic Control — Faculty of Engineering

Total Marks: 60 Marks

Course Title: Computer Technology	Course Code: CCE0101	Year: Preparatory
Date: 3-2-2022	Allowed time: 3 hrs.	Model: A

Q.1) Choose the correct answer : **(Q1+Q2 50 Marks)**

1.1) ..... computer is a form of computer that uses the continuously changeable aspects of physical phenomena.
A) A Digital B) An analog C) A Hybrid

1.2) Which of the following is the most powerful type of computers?
A) Super conductor B) Microcomputer C) Super computer D) Mainframe

1.3) It is specified as a main memory
A) Hard disk B) CD/DVD C) RAM D) Floppy disk

1.4) Multi-programmed Batch Systems .....
A) decreases CPU utilization C) increases CPU utilization
B) decreases RAM utilization D) increases RAM utilization

1.5) Which one of the following is an application software package?
A) Windows B) Red hat Linux C) Microsoft Office D) All the above

1.6) The input device to the computer is
A) a mouse B) touch screen C) a keyboard D) all the above

1.7) The mail server for the E-mail address: ahmed@gmail.com is:
A) gmail B) ahmed C) gmail.com D) ahmed@gmail.com

1.8) A user can make any change in the image using -
A) Interactive computer graphics C) Both (A) & (B)
B) Non-Interactive computer graphics D) None of the above

1.9) The process of copying data from a memory location is called .....
A) Writing B) Controlling C) Booting D) Reading

1.10) $(25)_{10} = (\ ?\ )_2$
A) $(11001)_2$ B) $(10010)_2$ C) $(11010)_2$ D) $(10011)_2$

1.11) A relational database consists of a collection of
A) keys B) records C) tables D) fields

1.12) In a client/server model, a client .....
A) asks for information C) provides information and files
B) serves software files to other computers D) distributes data files to other computers

1.13) Operating system manages
A) Memory B) Processor C) I/O devices D) All the above

1.14) Laser Lights are used in its read / write operations:
A) Hard disk. B) CD/DVD C) Magnetic disk D) USB flash memory

1.15) In which of the operating systems, the response time is very critical:
A) Batch operating systems B) Time-Sharing systems C) Real time operating systems

1.16) Programming language used in program development is ....
A) Prolog B) Java C) MySQL D) VHDL

1.17) The ..... operation is a unary operation that modifies records in a database table
A) Update B) Insert C)Delete D) Join

1.18) Types of Operating Systems: .....
A) DOS B) OS/2 C) MAC D) All the above

1.19) ..... is the software responsible for running programs and providing secure access to the machine's hardware.
A) wildcard B) kernel C) Microsoft Access D) All the above

1.20) Real-time systems are .....
A) Special purpose operating systems C) General purpose operating systems
B) Hard [illegible] D) Soft operating systems

1.21) $(10111)_2 = (\ldots\ldots?\ldots)$
A) $(29)_{10}$ [illegible] C) None of these

1.22) Multiprocessor Systems refer to the use of two or more ..... within a single computer system.
A) CPU [illegible] C) RAM D) Hard disk

1.23) ..... controls peripherals such as printers and modems.
A) CPU B) ROM C) Operating System D) All the above

1.24) In time sharing systems, processor's time is shared among multiple .....
A) CPUs B) Hard disks C) users D) All the above

1.25) To repeat the running of the same commands more than one time, ... structure is used.
A) selection B) loop C) sequential D) SQL

1.26) Which protocol is used to report error message:
A) TCP B) IP C) ICMP D) SMTP

1.27) The primary job of the Operating System is .....
A) manage commands B) manage resources C) manage programs

1.28) You can enter your username in ...
A) button B) label C) textbox D) form

1.29) Multimedia means the use of more than one _____ in communication.
A) file B) number C) media D) sound

1.30) ..... structure allows a program to make a decision on certain condition.
A) Loop B) Sequential C) Hierarchical D) Selection

1.31) Freeware software available via FTP: .....
A) The author permits you to use it free. C) You can use for short-term for evaluation.
B) The author carries no copyright. D) None of these.

1.32) A company has 10 branches distributed over the cities of Egypt, the appropriate type of network for connecting these branches is .....network.
A) PAN. B) WAN C) LAN D) MAN.

1.33) FTP is .....
A) Internet browser B) Search engine C) Internet protocol D) None of these

1.34) EEPROM stands for .....
A) Electronically Erasable Programmable Read-Only Memory
B) Electrically Erasable Programmable Read-Only Memory
C) Electrically Enabled Programmable Read Only Memory

1.35) Tel net is ..... and used in .....
A) Internet browser, displaying web pages C) Internet protocol, transferring web pages
B) Internet protocol, file transfer D) Internet protocol, remote log in

1.36) A banking system uses ..... networks.
A) Client/Server B) PAN C) Peer-to-Peer D) None of these

1.37) RGB code of the white color is ...
A) 255,255,0 B) 0,0,255 C) 0,0,0 D) 255,255,255

1.38) Programming language used in web page development is ....
A) Visual Basic B) HTML C) SQL D) Assembly

1.39) Which one of the following is not a network topology?
A) Star B) Ring C) LAN D) Bus

1.40) Which of the following is not a level of data abstraction?
A) view level B) physical level C) logical level D) critical level

1.41) Complete the following command with the most suitable, ...text = sum
A) Button1 B) label1 C) textbox1 D) form1

1.42) SQL can be used to .....
A) create database structures only. C) modify database data only.
B) query database data only. D) All of the above

1.43) In ..... multiple users simultaneously access the system through terminals.
A) Multiprogrammed Batch systems C) Simple Batch Systems
B) time sharing operating systems D) Real-time systems

1.44) Interactive computer graphics uses various kind of input devices such as
A) Mouse B) Graphic tablet C) Joystick D) All of these

1.45) Unix operating system is .....
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1.46) ..... is the class of network we encounter in the university.
A) PAN B) LAN C) MAN D) WAN

1.47) _____ is the most important/powerful computer in a typical network.
A) Network server B) Network client C) Network switch

1.48) A collection of hyperlinked documents on the internet forms
A) World Wide Web (WWW) B) Mailing list C) Hypertext markup language

1.49) Database System ≡ Database + ……..
A) SQL B) DBMS C) ERD D) DDL

1.50) _____ is a dynamic element.
A) Text B) Graphics C) Video D) Hypertext

1.51) URL stands for……
A) Universal region locator C) Universal resource locator
B) Uniform resource locator D) None of these

1.52) To make the biggest Heading of a web page , write
A) <html> </html> B) <h1> Heading </h1> C) <h2> Heading </h2>

1.53) Super computers are mainly useful for ……
A) Data-retrieval operations C) Input-output intensive applications
B) Mathematical intensive scientific applications D) None of these

1.54) To make a title of a web page , write
A) <html> </html> C) <h1> Heading </h1>
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1.55) It is specified as a non- volatile secondary memory
A) Hard disk B) RAM C) ROM D) All the above

Q.2) State if each of the following statements is True or False:

2.1) A Process is a systematic series of actions a computer uses to manipulate data.
2.2) Computer output is information that has been produced by a computer.
2.3) A server is a computer on a network that provides a service to other computers.
2.4) Hardware is the physical parts of a computer system that you can see and touch.
2.5) Every general-purpose computer must have an operating system to run other programs.
2.6) A bit is the smallest unit of information held in a computer.
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2.11) A minicomputer is usually designed to serve multiple users simultaneously.
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Where the result set obtained after this operation is the common rows between them.
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2.18) Multimedia elements can be classified into static and dynamic elements.
2.19) Time-Sharing operating systems use the CPU switching between multiple jobs.
2.20) In multiprogramming, the CPU will never be idle.
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2.23) The Internet is often considered the most complex engineered system on the earth surface.
2.24) No one owns the Internet.
2.25) Disadvantages of File systems to store data is data isolation
2.26) Peer-to-peer networks are more commonly implemented where larger than ten computers are involved.
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2.28) A central computer acts as the storage location for files and applications shared on the network.
2.29) In Client/server networks the server needs to run an operating system that supports networking.
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2.31) RGB code of the black color is 0,0,0
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2.40) Google is not a web browser
2.41) In Visual Basic, the command Me.BackColor = Yellow is correct?
2.42) The mail server name in Omar@tanta.edu.eg is tanta.edu.eg
2.43) In search window of Windows, a wildcard character is a special symbol that stands for one or more unknown characters.
2.44) HTTP is an Internet browser
2.45) Multimedia involves only one (1) media type.

Q.3) Write the question then write the answer: (10 Marks)

a) Write short notes about four different types of computers. (3 Marks)
b) Define the priority of the operations in the following expression,
A*(B+C) + D/(A*2.0) (2 Marks)
c) What are the main components of an operating system? Write short notes about them? (3 Marks)
d) What is meant by the data security? How can you achieve that in your computer? (2 Marks)

Tanta University | Department: Computers and Automatic Control | Faculty of Engineering

Total Marks: 60 Marks

Course Title: Computer Technology	Course Code: CCE0101	Year: Preparatory
Date: 3-2-2022	Allowed time: 3 hrs.	Model: B

Q.1) Choose the correct answer : **(Q1+Q2 50 Marks)**

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2.45) Multimedia involves only one (1) media type.

Q.3) Write the question then write the answer: (10 Marks)

a) Write short notes about four different types of computers. (3 Marks)
b) Define the priority of the operations in the following expression,
A*(B - C) - D/(A*2.0) (2 Marks)
c) What are the main components of an operating system? Write short notes about them? (3 Marks)
d) What is meant by the data security? How can you achieve that in your computer? (2 Marks)

Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. kcn335	Allowed time	3 hours

Part one :Answer the following questions in the electronic sheet

First Question : Choice the correct answer :

1- A mixture containing 40% benzene (B) and toluene (T) by mass is fed to a distillation column by a rate 2000 Kg/hr. An overhead stream of 98wt% B is produced, and 95% of the Toluene leaves in the bottom stream. The rate of the vapor leaved from the top of the distillation column was four times of the amount of the distillate. Assuming basis is one hour

The amounts of distillate leave the condenser to be final product = ……Kg
a) 753 b) 2000 c)1247 d) 3012

2- In the question (1) the amount of Benzene in the distillate = ……Kg
a) 753 b) 738 c)2000 d) 15

3- In the question (1) the amount of the bottom product = ……Kg
a) 753 b) 3012 c)2000 d) 1247

4- In the question (1) the amount of Toluene in the bottom product = ……Kg
a) 753 b)1247 c) 1184 d) 63

5- In the question (1) the amount of vapor leave the top of the distillation column product = ……Kg
a) 2000 b) 3012 c)1184 d) 1247

6- In the question (1) the amount of liquid leave the condenser = ……Kg
a) 2259 b) 3012 c) 2000 d) 1247

7- In the question (1) the returned ratio (R) =……
a) 3 b) 2 c) 1 d) 4

8- Gaseous Fuel used in a furnace Its Composition as the following :

Element	C	H_2	O_2	S	N_2	H_2O	ash
% by weight	89%	3%	2%	1%	2%	2%	1%

The weight of oxygen needed from the air needed to burn one hundred kilogram from that fuel (complete combustion) = ……Kg
a) 263 b) 261 c) 1135 d)864

9- In the question (8) the weight of air needed to burn one hundred kilogram from that fuel (complete combustion) = ……Kg
a) 263 b) 261 c) 1135 d) 864

10- In the question (8) the weight of carbon dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ……Kg
a) 327 b)238 c) 251 d) 1135

11- In the question (8) the weight of water vapour produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ……Kg
a) 327 b) 29 c)24 d) 251

12- In the question (8) the weight of sulphur dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ……Kg
a) 1 b) 0.5 c) 2 d) 0.3

13- In the question (8) the total weight of combustion products (dry products burning one hundred kilogram from that fuel complete combustion) = ……Kg
a) 1233.5 b) 1231.5 c) 1204.5 d)1206.5

١٤- محلول يتكون من كلوريد الصوديوم تركيزه ٥ جرام مكافئ / لتر طريقة التعبير عن التركيز هنا هي .....
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٥- عند ذوبان مادة صلبة في سائل فإن درجة التجمد للمحلول الناتج تكون .....مقارنة بالسائل النقي.
أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١٦- عند ذوبان مادة صلبة في سائل فإن درجة الغليان للمحلول الناتج تكون .....مقارنة بالسائل النقي.
أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١٧- جرام جزيئي / لتر هي أحد وحدات التعبير عن التركيز وهي وحدة قياس .....
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٨- ..... = عدد الجرامات المذابة في 1000 جرام مذيب / الوزن الجزيئي
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٩- معدنان أ درجة إنصهاره 1000 ° م ، ب درجة إنصهاره 1850 ° م ، تاما الإمتزاج في حالتي الصلب و المصهور ، وتبدأ السبيكة المحتوية علي 60% أ في التجمد عند درجة حرارة 1300 ° م وتنفصل منها مادة صلبة تحتوي علي 70% "ب" في حين تبدأ السبيكة المحتوية علي 40% أ في التجمد عند درجة حرارة 1500° م وتنفصل منها مادة صلبة تحتوي علي 90% "ب". للسبيكة التي تحتوي علي 50% أ درجة بداية التجمد =.....° م
أ) 1400 ب) 1000 ج) 1850 د) 1210

٢٠- في السؤال (19) للسبيكة التي تحتوي علي 50% أ درجة نهاية التجمد =.....° م
أ) 1400 ب) 1210 ج) 1850 د) 1000

٢١- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المادة الصلبة فيها =.....% (أ)
أ) 68 ب) 32 ج) 59 د) 41

٢٢- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المصهور فيها =.....% (أ)
أ) 68 ب) 41 ج) 59 د) 32

٢٣- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....
أ) 1 ب) 2 ج) 0 د) 3

٢٤- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1600° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....
أ) 1 ب) 2 ج) 0 د) 3

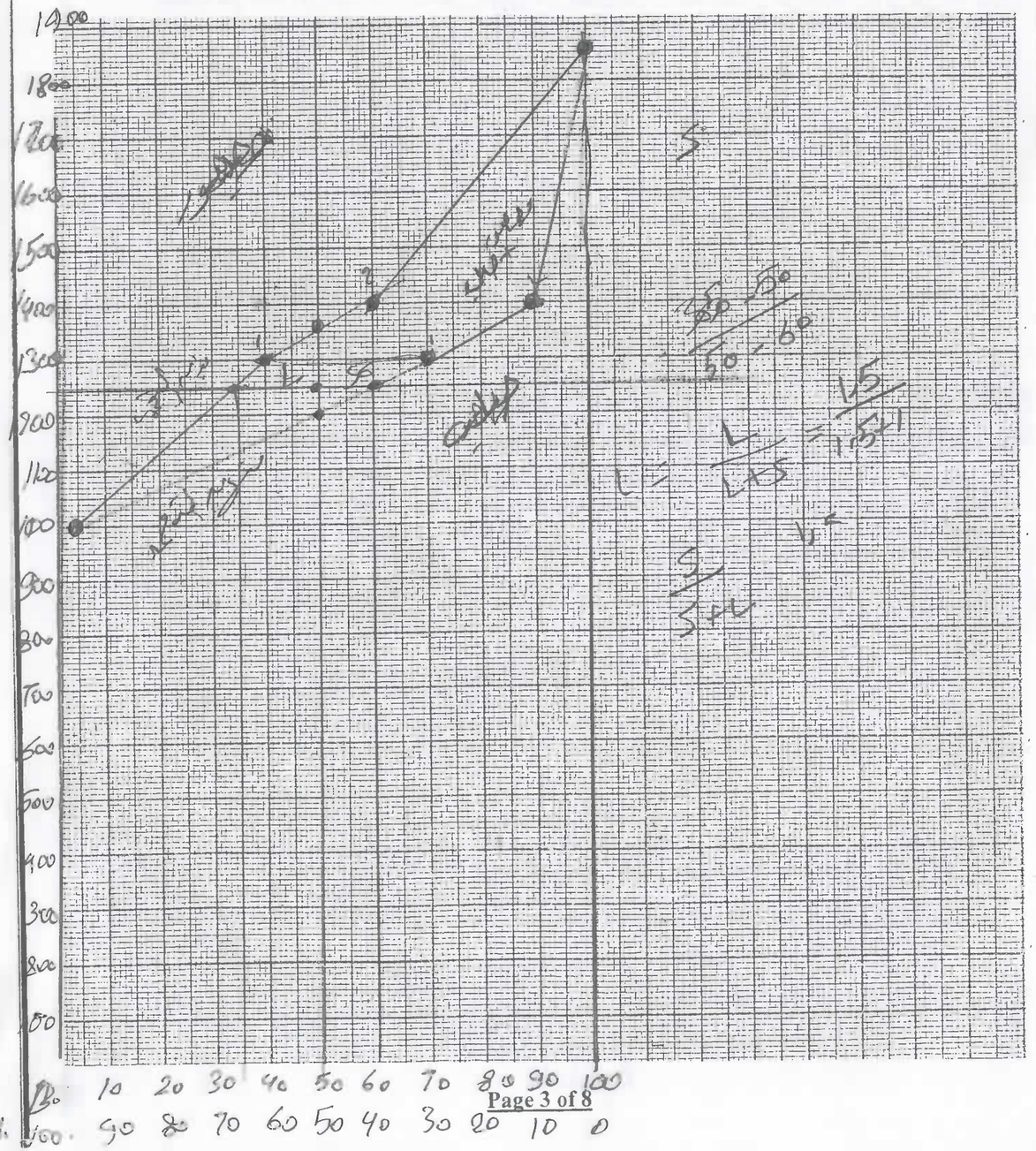
Question (2):

Write (√) for the true statement and write (x) for the false sentence in the answer sheet

1. Combustion is a chemical reaction between an oxidant and fuel. (√)
2. Material balance equation can be done on chemical process as the form the input to the process equal the output of the process. (√)
3. Atmospheric air consists of 77% N_2 and 23 % O_2 by volume.....(√)

٤. مثال علي الحيود السالب محاليل الماء والميثانول.(√)
٥. كلما زادت درجة الحرارة تزداد ذوبانية كلا من غازي الارجون وثاني أكسيد الكربون في المذيبات الهيدروكربونية في مدي درجات الحرارة من ٢٨٨° كلفن إلي ٣٠٣° كلفن.(√)
٦. السلوك المثالي للسوائل هو عبارة عن السلوك الذي تتساوي فيه جميع قوي التجاذب مابين المكونات وبعضها وبين السوائل النقية.(√)
٧. ذوبان الأكسجين في الماء يتبع قانون هنري للذوبانية الغازات في السوائل.(√)
٨. ينطبق قانون راؤولت علي السوائل العديمة الإمتزاج.(√)
٩. في الحيود الموجب عن قانون راؤولت يزداد الحجم والضغط وتزداد درجة الحرارة.(√)
١٠. في الحيود الموجب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أكبر من قويالتجاذب بين جزيئات السائل النقي.(√)
١١. الضغط البخاري للمحلول أكبر من الضغط البخاري للسائل النقي.(√)
١٢. في الحيود السالب عن قانون راؤولت يقل الحجم والضغط وتقل درجة الحراره.(√)
١٣. المحاليل هي مخاليط متجانسة وتكون نسب مكوناتها متغيرة وبذلك تختلف عن المركب الكيميائي.(√)
١٤. كلا من الغازات الأتية شره الذوبان في الماء غاز كلوريد الهيدروجين ، النشادر ،ثاني أكسيد الكبريت (×)
١٥. مثال علي الحيود الموجب خليط الكلوروفورم و الأسيتون.(×)
١٦. للحصول علي محاليل من النوع صلب في صلب لابد أولا من تحويل المادة الصلبة إلي سائلة عن طريق الذوبان في الماء مثل جميع السبائك.(×)
١٧. إتحاد أكسيد الكالسيوم مع ثاني أكسيد الكربون إحدي صور ذوبان المادة الصلبة في الغازات.(√)
١٨. بزيادة مساحة السطح تقل عملية الإدمصاص.(√)
١٩. في الحيود السالب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أقل من قوي التجاذب بين جزيئات السائل النقي.( )

End of first part questions .....



Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. ckm253	Allowed time	3 hours

Part two :Answer the following questions in the electronic sheet

25. Which of the following processes *always* results in an increase in the energy of a system?
A. The system loses heat and does work on the surroundings.
B. The system gains heat and does work on the surroundings.
C. The system loses heat and has work done on it by the surroundings.
D. The system gains heat and has work done on it by the surroundings.
E. None of these is always true.

26. A gas is compressed in a cylinder from a volume of 20 L to 2.0 L by a constant pressure of 10.0 atm. Calculate the amount of work done on the system.

A. 1.01×10^4 J B. -180 J C. 1.84×10^4 J D.-1.81×10^4 J E.180J

27. According to the first law of thermodynamics:
A. Energy is neither lost nor gained in any energy transformations.
B. Perpetual motion is possible.
C. Energy is conserved in quality but not in quantity.
D. Energy is being created as time passes. We have more energy in the universe now than when time began.

28. Which of these processes is *endothermic*?
A. $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$ B. $H_2O(g) \rightarrow H_2O(l)$
C. $3O_2(g) + 2CH_3OH(g) \rightarrow 2CO_2(g) \div 2H_2O(g)$ D. $H_2O(s) \rightarrow H_2O(l)$

29. An endothermic reaction causes the surroundings to
A. warm up. B. become acidic. C. condense. D.decrease in temperature.

30. An exothermic reaction causes the surroundings to
A. warm up. B. become acidic. C. expand. D. decrease its temperature

31. 4. A sample of nitrogen gas has a volume of 32.4 L at 20°C. The gas is heated to 220°C at constant pressure. What is the final volume of nitrogen?
A. 2.94 L B. 19.3 L C. 31.4 L D. 54.5 L E. 356 L

32. A sample of N_2 gas occupies 2.40 L at 20°C. If the gas is in a container that can contract or expand at constant pressure, at what temperature will the N_2 occupy 4.80 L?
A. 10°C B. 40°C C. 146°C D. 313°C E. 685°C

33. If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?
A. 8 B. 2 C. 1/2 D. 1/4 E. 1/8

34. A mixture of gases contains 4.46 moles of neaon (Ne) . 0.74 mole of argon (Ar) and 2.15

moles of xenon (Xe) .Calculate the partial pressures of the argon (Ar) gas if the total pressure is 2.00 atm at a certain temperature.

[a] 0.10 atm [b] 0.586 atm [c] 0.20 atm [d] 1.21 atm

35.Calculate the number of liters of carbon dioxide measured at STP that could be produced from 7.45 g of propane.
A) 1.90 L CO2 B) 3.80 L CO2 C)12.5 L CO2 D)11.4 L CO2

36. Samples of the following volatile liquids are opened simultaneously at one end of a room. If you are standing at the opposite end of this room, which species would you smell first?[Assume that your nose is equally sensitive to all these species.
a. ethyl acetate ($CH_3COOC_2H_5$) b. camphor ($C_{10}H_{16}O$)
c. naphthalene ($C_{10}H_8$) d. diethyl ether ($C_2H_5OC_2H_5$)

37. The unit(s) of free energy change $\Delta G°$ is(are) _____.
A. J·mol–1 B. J C. J·mol–1·K–1 D. J·K·mol–1

38. During the interaction between the system and the surrounding the amount of energy gained by the system must be exactly equal to the amount of energy lost the surrounding .
a. First law of thermodynamic b. Second law of thermodynamic
c. Third law of thermodynamic d . Zero law of thermodynamic

39. They are related to the molecular structure of a system and the degree of the molecular activity.
a. microscopic form of energy. b .a macroscopic form of energy.
c. Chemical energy. d. a&c

40. Greater value of standard reduction potential greater will be tendency
A.to get oxidized B. to get reduced C. accept electrons D. both b and c

41.The half cells are interconnected through.
A.Wire B. salt bridge C. electric circuit D. no connection exists

42. What is $\Delta G°$ per mole of dichromate ions for the reduction of dichromate ions, $Cr_2O_7^{2-}$, to Cr^{3+} by bromide ions, Br^-, in acidic solution in galvanic cell? (Hint: Use the standard cell potential.)
(a) +26.3 kJ (b) -158 kJ (c) +158 kJ (d) -26.3 Kj

43. The amount of heat required to rise the temperature of 1lbm of distilled water 1^0F
a-Specific heat b- Btu c- Calory d- Heat capacity

44. The total entropy of a mixture of gases is the ____ of the partial entropies.

38. Anodic inhibitors are substances such as Na_2CO_3 that react with the anodically formed Fe ions to form insoluble iron carbonate which deposit on the anode and isolate it from the corrosive medium.....(✗)
39. Cathodic protection of underground steel pipeline is carried out (externally using less Nobel galvanic anode (galvanic cell) Zn or Mg rod .....(✓)
40. Presence of differential aeration oxygenation cells takes place due to the difference in the porosity of the concrete , This is the most common reason which causing Corrosion of Steel Reinforcement in Concrete.....(✓)
41. Dissimilar metal corrosion cells are set up when two different metals become in contact with each other in the presence of an electrolyte .....(✓)
42. The less Nobel metals acts as the anode and the more Nobel metals acts as the cathode where H2 evaluation takes place in the electrochemical cell .....(✗)
43. Differential aeration (oxygenation)cells: This type of corrosion cells takes place whenever there is a difference in the dissolved O2 conc. Where O_2poor area acts as the anode and the O2 rich area act as the cathode.....(✗)
44. .Chemical corrosion takes place due to direct attack by acids or alkalis.....(✓)
45. Metals above H_2 in the e.m.s do not dissolve in acids (known by Nobel metals)because it is difficult to loss their electrons and difficult to convert into ions..... (✗)
46. Temporary Coating (coating with lubricating oil or Vaseline which removed easily by an organic solvent .....(✓)
47. coating with more Nobel metal(must not be free from cracks or pores)like Zn.... .(✓)
48. Presence of dissimilar metal corrosion cell is the most common reason which causing Corrosion of Steel of Reinforcement in Concrete..... (✓)
49. Temporary Coating is not one of the Methods of protecting metals against corrosion.....(✓)
50. In the metallic coating : Coating with more Nobel metal must be free from cracks or pores (like Cu).....(✗)
51. The passive layer formed on the reinforcement steel is a Layer of the iron oxides and hydroxides formed on the reinforcement steel as a result of exposing it to the atmospheric oxygen.....(✓)
52. If the amount of calcium increases in the mixture too much during the production of cement , The cement damaged and exposed to cracking..... (✓)
53. Reactions inside the rotary kiln (furnace) , Part of Iron oxide reacts with Al_2O_3 and CaO to form C4AF..... (✗)
54. The compounds which are responsible for final strength of Cement is Tricalcium silicate & Tricalcium Aluminate..... (✗)

C25

End of questions ..... Best Wishes

Prof. Dr. Mona Ahmed Darweesh *Dr. Wafaa Ahmed Hammad*

Reduction reaction of metal	Standard reduction potential : $E°$ (V)
$Au^+ + e^- \rightleftharpoons Au(s)$	1.83
$Au^{3+} + 2e^- \rightleftharpoons Au^+$	1.36
$Au^{3+} + 3e^- \rightleftharpoons Au(s)$	1.52
$AuCl_4^- + 3e^- \rightleftharpoons Au(s) + 4Cl^-$	1.002
$Fe^{2+} + 2e^- \rightleftharpoons Fe(s)$	−0.44
$Fe^{3+} + 3e^- \rightleftharpoons Fe(s)$	−0.037
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	0.771
$Mn^{2+} + 2e^- \rightleftharpoons Mn(s)$	−1.17
$Mn^{3+} + e^- \rightleftharpoons Mn^{2+}$	1.5
$MnO_2(s) + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O(l)$	1.23
$MnO_2(s) + 4H^+ + e^- \rightleftharpoons Mn^{3+}(aq) + H_2O(I)$	0.95
$MnO_4^- + 4H^+ + 3e^- \rightleftharpoons MnO_2(s) + 2H_2O(l)$	1.70
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O(l)$	1.51
$Ag^+ + e^- \rightleftharpoons Ag(s)$	0.7996
$AgBr(s) + e^- \rightleftharpoons Ag(s) + Br^-$	0.071
$Ag_2C_2O_4(s) + 2e^- \rightleftharpoons 2Ag(s) + C_2O_4^{2-}$	0.47
$Ga^{3+} + 3e- \rightleftharpoons Ga(s)$	-0.56
$Cu^+ + e^- \rightleftharpoons Cu(s)$	0.520
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	0.159
$Cu^{2+} + 2e^- \rightleftharpoons Cu(s)$	0.3419
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	1.087
$HOBr + H^+ + 2e^- \rightleftharpoons Br^- + H_2O(l)$	1.341
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	−0.424
$Cr^{2+} + 2e^- \rightleftharpoons Cr(s)$	−0.90
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O(l)$	1.36
$Mg^{2+} + 2e^- \rightleftharpoons Mg(s)$	−2.356
$Mg(OH)_2(s) + 2e^- \rightleftharpoons Mg(s) + 2OH^-$	−2.687
$Al^{3+} + 3e^- \rightleftharpoons Al(s)$	−1.676
$Al(OH)_4^- + 3e^- \rightleftharpoons Al(s) + 4OH^-$	−2.310

(a) average b) weighted mean c) sum d) difference of the highest and the lowest

45. The Chemical Composition of a sample of cement are as the following: (loss 0.81% , SO_3 2.37% , MgO 0.79% , Fe_2O_3 3.11% , Al_2O_3 4.74% , SiO_2 23.44% , CaO 64.74%). Calculate the weight % of the following compounds :the Silica modulus equal____
A. 1 B. 1.52 C. 2.07 D. 2.99

46.From the previous problem (45) calculate the alumina modulus ?
A. 1.52 B.1 C. 2.99 D. 2.07

47. From the problem no.(45) calculate the hydraulic modulus ?
A. 1 B. 2.99 C.1.52 D. 207

48. Lime Stone is one from Raw materials used in the manufacture of cement: which is consider as a source of..... A. Al_2O_3 B. Al_2O_3 & SiO_2 C. CaO D. SiO_2

49. Sand added to adjust the composition of the mixture used in the manufacture of cement t reach % SiO2 =.....in the Cement. A. 11% B. 21 % C.22% D. 12%

50. The choose of the suitable method for the production of cement depends on.....

a. type of the raw materials b. the availability of the fuel. c. quality of the raw materials d.All the previous

51. If the amount of Al_2O_3 ....., the burning of cement will occur at .....temperatu and the produced cement will be fast –hardening .

A. decreases -high B. increases -high C. increases -low D. decreases -low

52. If carbon dioxide molecules effuse at an average rate of 5 mol/s, at what rate would diatomic hydrogen molecules effuse in the exact same conditions?
a) 23.5 mol/s b) 4.7 mol/s c)110 mol/s d)Not enough information is provided

53. Choose the substance with the higher entropy per mole at a given temperature: $CO_2(g)$ *or* $CO_2(aq)$.
a. $CO_2(g)$. b. $CO_2(g)$ & $CO_2(aq)$. C. CO2(s). D. $CO_2(aq)$

54. Consider an electrochemical cell constructed from the following half cells, linked by an external circuit and by a KCl salt bridge. • an Al(s) electrode(anode) in 1.0 M $Al(NO_3)_3$ solution • a Pb(s) electrode(cathode) in 1.0 M $Pb(NO_3)_2$ solution. The balanced overall (net) cell reaction is
A. $Pb(s) + Al^{3+}(aq) \rightarrow Pb^{2+}(aq) + Al(s)$. B. $3Pb(s) + 2Al^{3+}(aq) \rightarrow 3Pb^{2+}(aq) + 2Al(s)$.
C. $3Pb^{2-}(aq) + 2Al(s) \rightarrow 3Pb(s) + 2Al^{3+}(aq)$. D. $Pb^{2+}(aq) + Al(s) \rightarrow Pb(s) + Al^{3+}(aq)$.

55. Consider an electrochemical cell based on the following cell diagram:
$Pt \mid Pu^{3+}(aq), Pu^{4+}(aq) \parallel Cl_2(g), Cl^-(aq) \mid Pt$
the standard cell emf is 0.35 V and that the standard reduction potential of

chlorine is 1.36 V, what is the standard reduction potential $E°(Pu^{4+}/Pu^{3+})$?
A.2.37 V B.1.01 V C. -1.71 V D. -1.01 V

Question(2): .....

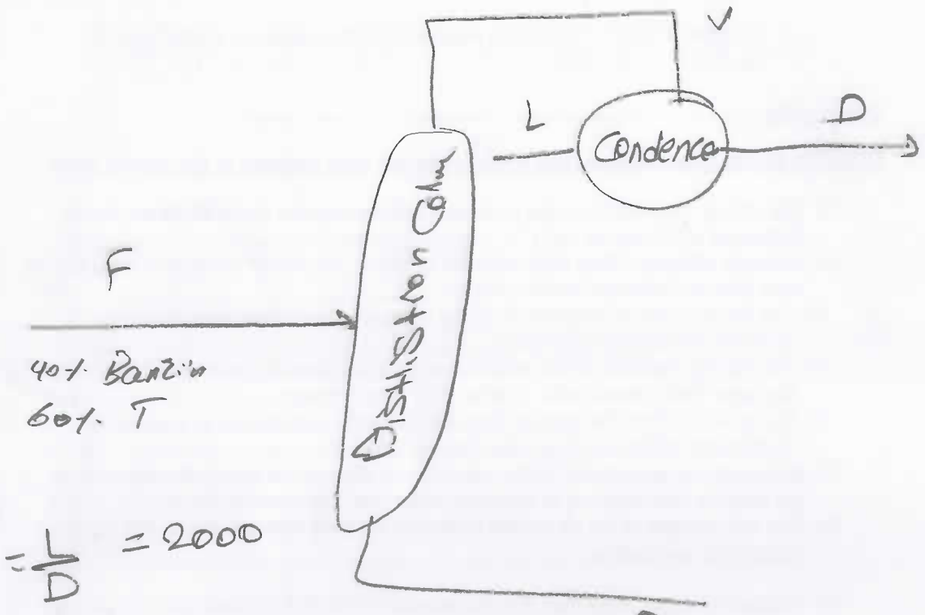
Write (√) for the true statement and write (x) for the false sentence in the answer sheet

20. The critical temperature in the pressure – volume diagram Upon which are drawn isothermal of CO curves is 31 °C .....(X)
21. Although effusion differs from diffusion in nature , the rate of effusion of a gas has the same form as Graham,s law of diffusion .....(√)
22. The few amounts of hardness remain in water after water treatment processes , it activates the corrosion problems..... (√)
23. The one-day strength of this cement is equal to the three-day strength of OPC with the same water-cement ratio, It is the High rapaid cement..... (X)
24. It is produced from the burning from the lime stone and Bauxite as a source of Aluminium oxides, it is Sea water Cement...Al2O3..... (X)
25. Increasing the permeability of the concrete will allow to the carbon dioxide from air and chloride from solution to penetrate to the steel and decrease the pH..... (√)
26. The least amount of the air needed to burn 29 Kg from butane $C_4H_{10}$is. 104 Kg (incomplete combustion).....

27. Adiabatic changes mean that: It is the process in which the system does not gain or loss heat . It is closed system.....
28. Kelvin – Planck statement of second law of thermodynamic: (No heat engine can have thermal efficiency100%)..... (√)
29. For a given substance the entropy always increases in the following order: S (solid) < S (liq) < S(gas). ..... (√)
30. The critical temperature for carbon dioxide is 304 K. That means that no amount of pressure applied to a sample of carbon dioxide gas at or above 304K.....
31. Gas Effusion is a direct demonstration of gaseous random motion is provided by diffusion , the gradual mixing of molecules of one gas with molecules of another by virtue of their kinetic properties. ..... (√)
32. When the combustion be incomplete :- part of carbon converted to carbon dioxide and the rest to carbon monoxide , all hydrogen converted to water and all sulphur converted to sulphur dioxide .....(√)
33. Atmospheric air consists of . 21% O_2 & 79% N_2 by weight...Volu.....(X)
34. 2.5 moles of O_2 is added to 5 moles of H_2 , Number of moles of H_2O will it produce are 5 moles..... (X)
35. The important factors which may influence the corrosion process are: Nature of the metal, nature of the environment and the corrosion products & Temperature only.....(X)
36. Inhibitors: They are Chemical substances added to the corrosive solution in a small amount (e.g.0.3%).....(X)
37. Passivators , such as hydrazine (N_2H_4) these substances takes O_2 from the corrosive solution.....(√)

2000 Kg/hr

98.1- Wt % B



Rate $= \frac{L}{D} = 2000$

Partial

General Matrial Balance on Distillation Column Benzen

$f = D + P$

$=$

Partial Matrial Balance on Condenser Benzen

$f * \frac{40}{100} =$

Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. kcm235	Allowed time	3 hours

Part one :Answer the following questions in the electronic sheet

First Question : Choice the correct answer :

1- A mixture containing 40% benzene (B) and toluene (T) by mass is fed to a distillation column by a rate 2000 Kg/hr. An overhead stream of 98wt% B is produced, and 95% of the Toluene leaves in the bottom stream. The rate of the vapor leaved from the top of the distillation column was four times of the amount of the distillate. Assuming basis is one hour

The amounts of distillate leave the condenser to be final product = ...Kg
a) 753 b) 2000 c)1247 d) 3012

2- In the question (1) the amount of Benzene in the distillate = ...Kg
a) 753 b) 738 c)2000 d) 15

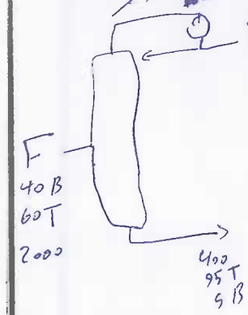
3- In the question (1) the amount of the bottom product = ...Kg
a) 753 b) 3012 c)2000 d) 1247

4- In the question (1) the amount of Toluene in the bottom product = ...Kg
a) 753 b)1247 c) 1184 d) 63

5- In the question (1) the amount of vapor leave the top of the distillation column product = ...Kg
a) 2000 b) 3012 c)1184 d) 1247

6- In the question (1) the amount of liquid leave the condenser = ...Kg
a) 2259 b) 3012 c) 2000 d) 1247

7- In the question (1) the returned ratio (R) =.....
a) 3 b) 2 c) 1 d) 4



٨- محلول يتكون من كلوريد الصوديوم تركيزه ٥ جرام مكافئ / لتر طريقة التعبير عن التركيز هنا هي .....
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

٩- عند ذوبان مادة صلبة في سائل فإن درجة التجمد للمحلول الناتج تكون .....مقارنة بالسائل النقي.
أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١٠- عند ذوبان مادة صلبة في سائل فإن درجة الغليان للمحلول الناتج تكون .....مقارنة بالسائل النقي.
أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١١- جرام جزيئي / لتر هي أحد وحدات التعبير عن التركيز وهي وحدة قياس .....
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٢- ..... = عدد الجرامات المذابة في 1000 جرام مذيب / الوزن الجزيئي
أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٣- معدنان أ درجة إنصهاره 1000 ° م ، ب درجة إنصهاره 1850 ° م ، تاما الإمتزاج في حالتي الصلب و المصهور ، وتبدأ السبيكة المحتوية علي 60% أ في التجمد عند درجة حرارة 1300 ° م وتنفصل منها مادة صلبة تحتوي علي 70% "ب" في حين تبدأ السبيكة المحتوية علي 40% أ في التجمد عند درجة حرارة 1500° م وتنفصل منها مادة صلبة تحتوي علي 90% "ب". للسبيكة التي تحتوي علي 50% أ درجة بداية التجمد =.....° م
أ) 1400 ب) 1000 ج) 1850 د) 1210

١٤- في السؤال (13) للسبيكة التي تحتوي علي 50% أ درجة نهاية التجمد =.....° م
أ) 1400 ب) 1210 ج) 1850 د) 1000

١٥- في السؤال (13) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المادة الصلبة فيها =.....% (أ)
أ) 68 ب) 32 ج) 59 د) 41

١٦- في السؤال (13) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المصهور فيها =.....% (أ)
أ) 68 ب) 41 ج) 59 د) 32

١٧- في السؤال (13) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....
أ) 1 ب) 2 ج) 0 د) 3

١٨- في السؤال (13) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1600° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....

3 (ب 0 (ج 2 (أ 1 (د

19- Gaseous Fuel used in a furnace Its Composition as the following :

Element	C	H_2	O_2	S	N_2	H_2O	ash
% by weight	89%	3%	2%	1%	2%	2%	1%

The weight of oxygen needed from the air needed to burn one hundred kilogram from that fuel (complete combustion) = ...Kg
a) 263 b) 261 c) 1135 d)864

20- In the question (19) the weight of air needed to burn one hundred kilogram from that fuel (complete combustion) = ...Kg
a) 263 b) 261 c) 1135 d) 864

21- In the question (19) the weight of carbon dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg
a) 327 b)238 c) 251 d) 1135

22- In the question (19) the weight of water vapour produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg
a) 327 b) 29 c)24 d) 251

23- In the question (19) the weight of sulphur dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg
a) 1 b) 0.5 c) 2 d) 0.3

24- In the question (19) the total weight of combustion products (dry products burning one hundred kilogram from that fuel complete combustion) = ...Kg
a) 1233.5 b) 1231.5 c) 1204.5 d)1206.5

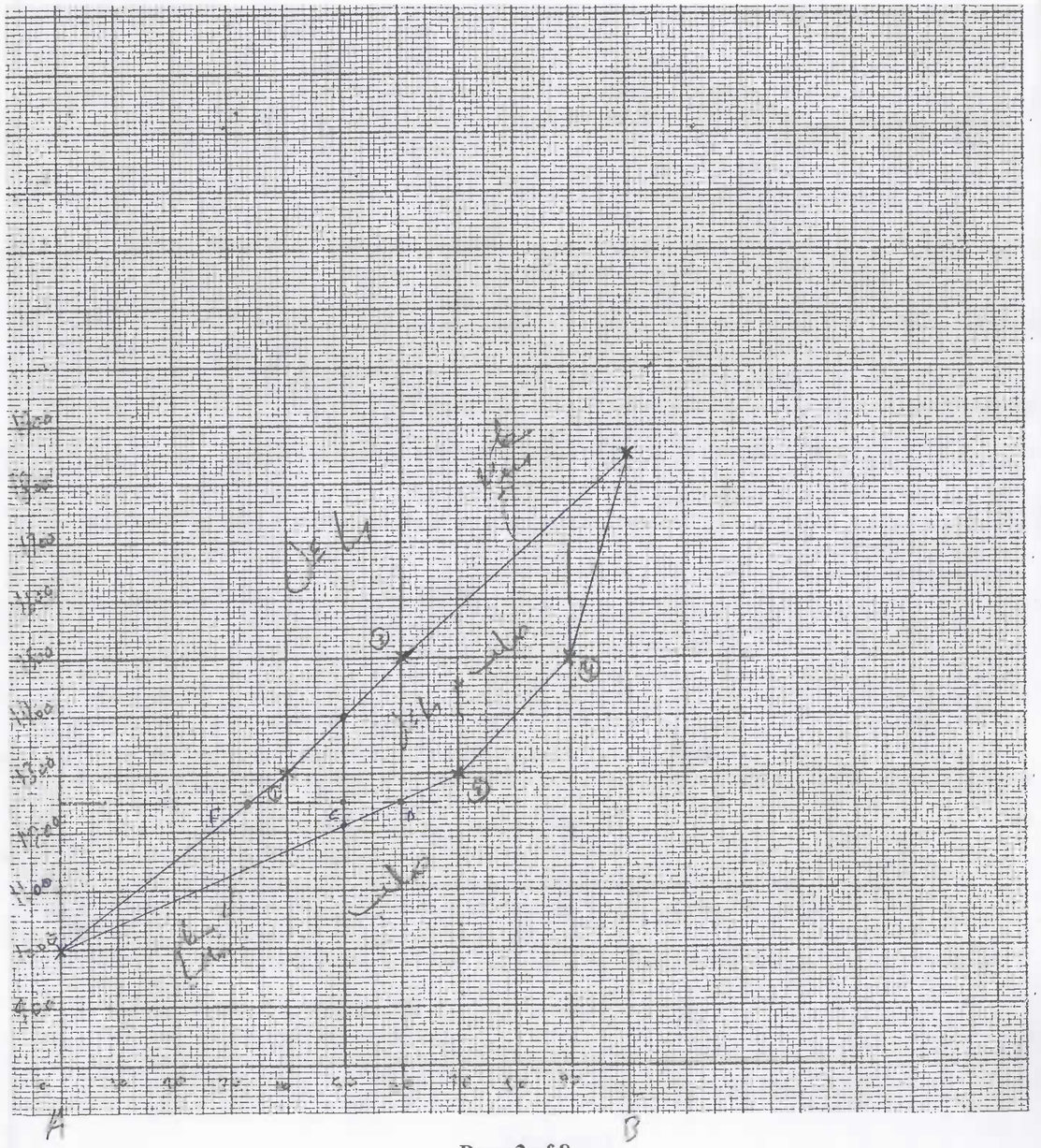
Question (2): .....

Write (√) for the true statement and write (x) for the false sentence in the answer sheet

1. Combustion is a chemical reaction between an oxidant and fuel. (√)
2. Material balance equation can be done on chemical process as the form the input to the process equal the output of the process. (√)
3. Atmospheric air consists of 77% N_2 and 23 % O_2 by volume .....(X)

٤. مثال علي الحيود السالب محاليل الماء والميثانول. (√)
٥. كلما زادت درجة الحرارة تزداد ذوبانية كلا من غازي الارجون وثاني أكسيد الكربون في المذيبات الهيدروكربونية في مدي درجات الحرارة من ٢٨٨° كلفن إلي ٣٠٣ ° كلفن. (X)
٦. السلوك المثالي للسوائل هو عبارة عن السلوك الذي تتساوي فيه جميع قوي التجاذب مابين المكونات وبعضها وبين السوائل النقية. (√)
٧. ذوبان الأكسجين في الماء يتبع قانون هنري للذوبانية الغازات في السوائل. (√)
٨. ينطبق قانون راؤولت علي السوائل العديمة الإمتزاج. (X)
٩. في الحيود الموجب عن قانون راؤولت يزداد الحجم والضغط وتزداد درجة الحرارة. (X)
١٠. في الحيود الموجب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أكبر من قويالتجاذب بين جزيئات السائل النقي. (X)
١١. الضغط البخاري للمحلول أكبر من الضغط البخاري للسائل النقي. (√)
١٢. في الحيود السالب عن قانون راؤولت يقل الحجم والضغط وتقل درجة الحرارة. (√)
١٣. المحاليل هي مخاليط متجانسة وتكون نسب مكوناتها متغيرة وبذلك تختلف عن المركب الكيميائي. (√)
١٤. كلا من الغازات الأتية شره الذوبان في الماء غاز كلوريد الهيدروجين ، النشادر ،ثاني أكسيد الكبريت. (√)
١٥. مثال علي الحيود الموجب خليط الكلوروفورم و الأسيتون. (X)
١٦. للحصول علي محاليل من النوع صلب في صلب لابد أولا من تحويل المادة الصلبة إلي سائلة عن طريق الذوبان في الماء مثل جميع السبائك. (X)
١٧. إتحاد أكسيد الكالسيوم مع ثاني أكسيد الكربون احدي صور ذوبان المادة الصلبة في الغازات. (X)
١٨. بزيادة مساحة السطح تقل عملية الإدمصاص. (X)
١٩. في الحيود السالب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أقل من قوي التجاذب بين جزيئات السائل النقي. (X)

End of first part questions ..... Best Wishes



Tanta University
Physical and Mathematical Engineering Department
Faculty of Engineering

Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. ckm253	Allowed time	3 hours

Part two :Answer the following questions in the electronic sheet

25. Which of the following processes *always* results in an increase in the energy of a system?
A. The system loses heat and does work on the surroundings.
B. The system gains heat and does work on the surroundings.
C. The system loses heat and has work done on it by the surroundings.
D. The system gains heat and has work done on it by the surroundings.
E. None of these is always true.

26. A gas is compressed in a cylinder from a volume of 20 L to 2.0 L by a constant pressure of 10.0 atm. Calculate the amount of work done on the system.

A. 1.01×10^4 J B. -180 J C. 1.84×10^4 J D. -1.81×10^4 J E.180J

27. According to the first law of thermodynamics:
A. Energy is neither lost nor gained in any energy transformations.
B. Perpetual motion is possible.
C. Energy is conserved in quality but not in quantity.
D. Energy is being created as time passes. We have more energy in the universe now than when time began.

28. Which of these processes is *endothermic*?
A. $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$ B. $H_2O(g) \rightarrow H_2O(l)$
C. $3O_2(g) + 2CH_3OH(g) \rightarrow 2CO_2(g) + 2H_2O(g)$ D. $H_2O(s) \rightarrow H_2O(l)$

29. An endothermic reaction causes the surroundings to
A. warm up. B. become acidic. C. condense. D. decrease in temperature.

30. An exothermic reaction causes the surroundings to
A. warm up. B. become acidic. C. expand. D. decrease its temperature

31. 4. A sample of nitrogen gas has a volume of 32.4 L at 20°C. The gas is heated to 220°C at constant pressure. What is the final volume of nitrogen?
A. 2.94 L B. 19.3 L C. 31.4 L D. 54.5 L E. 356 L

32. A sample of N_2 gas occupies 2.40 L at 20°C. If the gas is in a container that can contract or expand at constant pressure, at what temperature will the N_2 occupy 4.80 L?
A. 10°C B. 40°C C. 146°C D. 313°C E. 685°C

33. If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?
A. 8 B. 2 C. 1/2 D. 1/4 E. 1/8

34. A mixture of gases contains 1.46 moles of neaon (Ne) . 0.74 mole of argon (Ar) and 2 [illegible]

moles of xenon (Xe) .Calculate the partial pressures of the argon (Ar) gas if the total pressure is 2.00 atm at a certain temperature.

[a] 0.10 atm [b] 0.586 atm [c] 0.20 atm [d] 1.21 atm

35.Calculate the number of liters of carbon dioxide measured at STP that could be produced from 7.45 g of propane. C_3H_8
A) 1.90 L CO2 B) 3.80 L CO2 C)12.5 L CO2 D)11.4 L CO2

36. Samples of the following volatile liquids are opened simultaneously at one end of a room. If you are standing at the opposite end of this room, which species would you smell first?[Assume that your nose is equally sensitive to all these species.

a. ethyl acetate ($CH_3COOC_2H_5$) b. camphor ($C_{10}H_{16}O$)
c. naphthalene ($C_{10}H_8$) d. diethyl ether ($C_2H_5OC_2H_5$)

37. The unit(s) of free energy change $\Delta G°$ is(are) _____.
A. J·mol−1 B. J C. J·mol−1·K−1 D. J·K·mol−1

38. During the interaction between the system and the surrounding the amount of energy gained by the system must be exactly equal to the amount of energy lost the surrounding .

a. First law of thermodynamic b. Second law of thermodynamic
c. Third law of thermodynamic d . Zero law of thermodynamic

39. They are related to the molecular structure of a system and the degree of the molecular activity.
a. microscopic form of energy. b .a macroscopic form of energy.
c. Chemical energy. d. a&c

40. Greater value of standard reduction potential greater will be tendency
A.to get oxidized B. to get reduced C. accept electrons D. both b and c

41.The half cells are interconnected through.
A.Wire B. salt bridge C. electric circuit D. no connection exists

42. What is $\Delta G°$ per mole of dichromate ions for the reduction of dichromate ions, $Cr_2O_7^{2-}$, to Cr^{3+} by bromide ions, Br^-, in acidic solution in galvanic cell? (Hint: Use the standard cell potential.)
(a) +26.3 kJ (b) -158 kJ (c) +158 kJ (d) -26.3 Kj

43. The amount of heat required to rise the temperature of 1lbm of distilled water 1^0F
a-Specific heat b- Btu c- Calory d- Heat capacity

44. The total entropy of a mixture of gases is the ____ of the partial entropies.

a) average b) weighted mean c) sum d) difference of the highest and the lowest

45. The Chemical Composition of a sample of cement are as the following: (loss 0.81% , SO_3 2.37% , MgO 0.79% , Fe_2O_3 3.11% , Al_2O_3 4.74% , SiO_2 23.44% , CaO 64.74%). Calculate the weight % of the following compounds :the Silica modulus equal_____
A. 1 B. 1.52 C. 2.07 D. 2.99

46.From the previous problem (45) calculate the alumina modulus ?
A. 1.52 B.1 C. 2.99 D. 2.07

47. From the problem no.(45) calculate the hydraulic modulus ?
A. 1 B. 2.99 C.1.52 D. 207

48. Lime Stone is one from Raw materials used in the manufacture of cement: which is consider as a source of..... A. Al_2O_3 B. Al_2O_3 & SiO_2 C. CaO D. SiO_2

49. Sand added to adjust the composition of the mixture used in the manufacture of cement t reach % SiO2 =.....in the Cement. A. 11% B. 21 % C.22% D. 12%

50. The choose of the suitable method for the production of cement depends on.....

a. type of the raw materials b. the availability of the fuel. c. quality of the ra materials d.All the previous

51. If the amount of Al_2O_3 ....., the burning of cement will occur at .....temperatu and the produced cement will be fast –hardening .

A. decreases -high B. increases -high C. increases -low D. decreases -low

52. If carbon dioxide molecules effuse at an average rate of 5 mol/s, at what rate would diatomic hydrogen molecules effuse in the exact same conditions?
a) 23.5 mol/s b) 4.7 mol/s c)110 mol/s d)Not enough information is provided

53. Choose the substance with the higher entropy per mole at a given temperature: $CO_2(g)$ *or* $CO_2(aq)$.
a. $CO_2(g)$. d. b. $CO_2(g)$ & $CO_2(aq)$. C. CO2(s). D. $CO_2(aq)$

54. Consider an electrochemical cell constructed from the following half cells, linked by an external circuit and by a KCl salt bridge. • an Al(s) electrode(anode) in 1.0 M $Al(NO_3)_3$ solution • a Pb(s) electrode(cathode) in 1.0 M $Pb(NO_3)_2$ solution. The balanced overall (net) cell reaction is
A. $Pb(s) + Al^{3+}(aq) \rightarrow Pb^{2+}(aq) + Al(s)$. B. $3Pb(s) + 2Al^{3+}(aq) \rightarrow 3Pb^{2+}(aq) + 2Al(s)$.
C. $3Pb^{2+}(aq) + 2Al(s) \rightarrow 3Pb(s) + 2Al^{3+}(aq)$. D. $Pb^{2+}(aq) + Al(s) \rightarrow Pb(s) + Al^{3+}(aq)$.

55. Consider an electrochemical cell based on the following cell diagram:
$Pt \mid Pu^{3+}(aq), Pu^{4+}(aq) \parallel Cl_2(g), Cl^-(aq) \mid Pt$
Given that the standard cell emf is 0.35 V and that the standard reduction potential of

chlorine is 1.36 V, what is the standard reduction potential E°(Pu^{4+}/Pu^{3+})?
A.2.37 V B.1.01 V C. -1.71 V D. -1.01 V

Question(2): .....

Write (√) for the true statement and write (x) for the false sentence in the answer sheet

20. The critical temperature in the pressure – volume diagram Upon which are drawn isothermal of CO curves is 31 °C .....(√)
21. Although effusion differs from diffusion in nature , the rate of effusion of a gas has the same form as Graham,s law of diffusion .....(√)
22. The few amounts of hardness remain in water after water treatment processes , it activates the corrosion problems..... (√)
23. The one-day strength of this cement is equal to the three-day strength of OPC with the same water-cement ratio, It is the High rapaid cement..... (X)
24. It is produced from the burning from the lime stone and Bauxite as a source of Aluminium oxides, it is Sea water Cement..... (X)
25. Increasing the permeability of the concrete will allow to the carbon dioxide from air and chloride from solution to penetrate to the steel and decrease the pH..... (√)
26. The least amount of the air needed to burn 29 Kg from butane $C_4H_{10}$is. 104 Kg (incomplete combustion).....(X)
27. Adiabatic changes mean that: It is the process in which the system does not gain or loss heat . It is closed system..... (√)
28. Kelvin – Planck statement of second law of thermodynamic: (No heat engine can have thermal efficiency100%)..... (√)
29. For a given substance the entropy always increases in the following order: S (solid) < S (liq) < S(gas). ..... (√)
30. The critical temperature for carbon dioxide is 304 K. That means that no amount of pressure applied to a sample of carbon dioxide gas at or above 304K..... (X)
31. Gas Effusion is a direct demonstration of gaseous random motion is provided by diffusion , the gradual mixing of molecules of one gas with molecules of another by virtue of their kinetic properties. ..... (√)
32. When the combustion be incomplete :- part of carbon converted to carbon dioxide and the rest to carbon monoxide , all hydrogen converted to water and all sulphur converted to sulphur dioxide .....(√)
33. Atmospheric air consists of . 21% O_2 & 79% N_2 by weight..... (X)
34. 2.5 moles of O_2 is added to 5 moles of H_2 , Number of moles of H_2O will it produce are 5 moles..... (√)
35. The important factors which may influence the corrosion process are: Nature of the metal, nature of the environment and the corrosion products & Temperature only.....(X)
36. Inhibitors: They are Chemical substances added to the corrosive solution in a small amount (e.g.0.3%).....(√)
37. Passivators , such as hydrazine (N_2H_4) these substances takes O_2 from the corrosive solution.....(X)

38. Anodic inhibitors are substances such as Na_2CO_3 that react with the anodically formed Fe ions to form insoluble iron carbonate which deposit on the anode and isolate it from the corrosive medium.....(✓)
39. Cathodic protection of underground steel pipeline is carried out (externally using less Nobel galvanic anode (galvanic cell) Zn or Mg rod .....(✓)
40. Presence of differential aeration oxygenation cells takes place due to the difference in the porosity of the concrete , This is the most common reason which causing Corrosion of Steel Reinforcement in Concrete.....(✓)
41. Dissimilar metal corrosion cells are set up when two different metals become in contact with each other in the presence of an electrolyte .....(✓)
42. The less Nobel metals acts as the anode and the more Nobel metals acts as the cathode where H2 evaluation takes place in the electrochemical cell .....(✓)
43. Differential aeration (oxygenation)cells: This type of corrosion cells takes place whenever there is a difference in the dissolved O2 conc. Where O_2poor area acts as the anode and the O2 rich area act as the cathode.....(✓)
44. .Chemical corrosion takes place due to direct attack by acids or alkalis..... (✓)
45. Metals above H_2 in the e.m.s do not dissolve in acids (known by Nobel metals)because it is difficult to loss their electrons and difficult to convert into ions..... (✗)
46. Temporary Coating (coating with lubricating oil or Vaseline which removed easily by an organic solvent .....(✓)
47. coating with more Nobel metal(must not be free from cracks or pores)like Zn.... .(✗)
48. Presence of dissimilar metal corrosion cell is the most common reason which causing Corrosion of Steel of Reinforcement in Concrete..... (✗)
49. Temporary Coating is not one of the Methods of protecting metals against corrosion.....(✗)
50. In the metallic coating : Coating with more Nobel metal must be free from cracks or pores (like Cu).....(✓)
51. The passive layer formed on the reinforcement steel is a Layer of the iron oxides and hydroxides formed on the reinforcement steel as a result of exposing it to the atmospheric oxygen.....(✓)
52. If the amount of calcium increases in the mixture too much during the production of cement , The cement damaged and exposed to cracking..... (✓)
53. Reactions inside the rotary kiln (furnace) , Part of Iron oxide reacts with Al_2O_3 and CaO to form C4AF..... (✗)
54. The compounds which are responsible for final strength of Cement is Tricalcium silicate & Tricalcium Aluminate..... (✗)

silicate

End of questions ..... Best Wishes

Prof. Dr. Mona Ahmed Darweesh *Dr. Wafaa Ahmed Hammad*

Physical and Mathematical Engineering Department

Tanta University

Faculty of Engineering

Reduction reaction of metal	Standard reduction potential : $E°$ (V)
$Au^+ + e^- \rightleftharpoons Au(s)$	1.83
$Au^{3+} + 2e^- \rightleftharpoons Au^+$	1.36
$Au^{3+} + 3e^- \rightleftharpoons Au(s)$	1.52
$AuCl_4^- + 3e^- \rightleftharpoons Au(s) + 4Cl^-$	1.002
$Fe^{2+} + 2e^- \rightleftharpoons Fe(s)$	−0.44
$Fe^{3+} + 3e^- \rightleftharpoons Fe(s)$	−0.037
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	0.771
$Mn^{2+} + 2e^- \rightleftharpoons Mn(s)$	−1.17
$Mn^{3+} + e^- \rightleftharpoons Mn^{2+}$	1.5
$MnO_2(s) + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O(l)$	1.23
$MnO_2(s) + 4H^+ + e^- \rightleftharpoons Mn^{3+}(aq) + H_2O(I)$	0.95
$MnO_4^- + 4H^+ + 3e^- \rightleftharpoons MnO_2(s) + 2H_2O(l)$	1.70
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O(l)$	1.51
$Ag^+ + e^- \rightleftharpoons Ag(s)$	0.7996
$AgBr(s) + e^- \rightleftharpoons Ag(s) + Br^-$	0.071
$Ag_2C_2O_4(s) + 2e^- \rightleftharpoons 2Ag(s) + C_2O_4^{2-}$	0.47
$Ga^{3+} + 3e^- \rightleftharpoons Ga(s)$	-0.56
$Cu^+ + e^- \rightleftharpoons Cu(s)$	0.520
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	0.159
$Cu^{2+} + 2e^- \rightleftharpoons Cu(s)$	0.3419
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	1.087
$HOBr + H^+ + 2e^- \rightleftharpoons Br^- + H_2O(l)$	1.341
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	−0.424
$Cr^{2+} + 2e^- \rightleftharpoons Cr(s)$	−0.90
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O(l)$	1.36
$Mg^{2+} + 2e^- \rightleftharpoons Mg(s)$	−2.356
$Mg(OH)_2(s) + 2e^- \rightleftharpoons Mg(s) + 2OH^-$	−2.687
$Al^{3+} + 3e^- \rightleftharpoons Al(s)$	−1.676
$Al(OH)_4^- + 3e^- \rightleftharpoons Al(s) + 4OH^-$	−2.310

Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. kcw355	Allowed time	3 hours

Part one :Answer the following questions in the electronic sheet

First Question : Choice the correct answer :

1- Gaseous Fuel used in a furnace Its Composition as the following :

Element	C	H_2	O_2	S	N_2	H_2O	ash
% by weight	89%	3%	2%	1%	2%	2%	1%

The weight of oxygen needed from the air needed to burn one hundred kilogram from that fuel (complete combustion) = ...Kg

a) 263 b) 261 c) 1135 d)864

2- In the question (1) the weight of air needed to burn one hundred kilogram from that fuel (complete combustion) = ...Kg

a) 263 b) 261 c) 1135 d) 864

3- In the question (1) the weight of carbon dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg

a) 327 b)238 c) 251 d) 1135

4- In the question (1) the weight of water vapour produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg

a) 327 b) 29 c)24 d) 251

5- In the question (1) the weight of sulphur dioxide produced in combustion products (burning one hundred kilogram from that fuel complete combustion) = ...Kg

a) 1 b) 0.5 c) 2 d) 0.3

6- In the question (1) the total weight of combustion products (dry products burning one hundred kilogram from that fuel complete combustion) = ...Kg

a) 1233.5 b) 1231.5 c) 1204.5 d)1206.5

7- A mixture containing 40% benzene (B) and toluene (T) by mass is fed to a distillation column by a rate 2000 Kg/hr. An overhead stream of 98wt% B is produced, and 95% of the Toluene leaves in the bottom stream. The rate of the vapor leaved from the top of the distillation column was four times of the amount of the distillate. Assuming basis is one hour

The amounts of distillate leave the condenser to be final product = ...Kg

a) 753 b) 2000 c)1247 d) 3012

8- In the question (7) the amount of Benzene in the distillate = ...Kg

a) 753 b) 738 c)2000 d) 15

9- In the question (7) the amount of the bottom product = ...Kg

a) 753 b) 3012 c)2000 d) 1247

10- In the question (7) the amount of Toluene in the bottom product = ...Kg

a) 753 b)1247 c) 1184 d) 63

11- In the question (7) the amount of vapor leave the top of the distillation column product = ...Kg

a) 2000 b) 3012 c)1184 d) 1247

12- In the question (7) the amount of liquid leave the condenser = ...Kg

a) 2259 b) 3012 c) 2000 d) 1247

13- In the question (7) the returned ratio (R) =.....

a) 3 b) 2 c) 1 d) 4

١٤- محلول يتكون من كلوريد الصوديوم تركيزه ٥ جرام مكافئ / لتر طريقة التعبير عن التركيز هنا هي .....

أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٥- عند ذوبان مادة صلبة في سائل فإن درجة التجمد للمحلول الناتج تكون .....مقارنة بالسائل النقي.

أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١٦- عند ذوبان مادة صلبة في سائل فإن درجة الغليان للمحلول الناتج تكون .....مقارنة بالسائل النقي.

أ) أكبر من ب) أقل من ج) متساوية د) لا تؤثر

١٧- جرام جزيئي / لتر هي أحد وحدات التعبير عن التركيز وهي وحدة قياس .....

أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٨- عدد الجرامات المذابة في 1000 جرام مذيب =.....

أ) طريقة وزن الحجم ب) المولالية ج) العيارية د) المولارية

١٩- معدنان أ درجة إنصهاره 1000 °م، ب درجة إنصهاره 1850 °م ، تاما الإمتزاج في حالتي الصلب و المصهور ، وتبدأ السبيكة المحتوية علي 60% أ في التجمد عند درجة حرارة 1300 °م وتنفصل منها مادة صلبة تحتوي علي 70% "ب" في حين تبدأ السبيكة المحتوية علي 40% أ في التجمد عند درجة حرارة 1500 °م وتنفصل منها مادة صلبة تحتوي علي 90% "ب". للسبيكة التي تحتوي علي 50% أ درجة بداية التجمد =.....° م

أ) 1400 ب) 1000 ج) 1850 د) 1210

٢٠- في السؤال (19) للسبيكة التي تحتوي علي 50% أ درجة نهاية التجمد =.....° م

أ) 1400 ب) 1210 ج) 1850 د) 1000

٢١- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المادة الصلبة فيها =.....% (أ)

أ) 68 ب) 32 ج) 59 د) 41

٢٢- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م يكون تركيب السبيكة عبارة عن خليط من صلب ومصهور ويكون تركيب المصهور فيها =.....% (أ)

أ) 68 ب) 41 ج) 59 د) 32

٢٣- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1250° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....

أ) 1 ب) 2 ج) 0 د) 3

٢٤- في السؤال (19) للسبيكة التي تحتوي علي 50% أ عند درجة حرارة 1600° م بتطبيق قاعدة الطور تكون قيمة ال (F) =.....

أ) 1 ب) 2 ج) 0 د) 3

Question (2): .....

Write (√) for the true statement and write (x) for the false sentence in the answer sheet

1. Combustion is a chemical reaction between an oxidant and fuel. (√)
2. Material balance equation can be done on chemical process as the form the input to the process equal the output of the process. (√)
3. Atmospheric air consists of 77% N_2 and 23 % O_2 by volume .....(X)

٤. مثال علي الحيود السالب محاليل الماء والميثانول. (√)

٥. كلما زادت درجة الحرارة تزداد ذوبانية كلا من غازي الارجون وثاني أكسيد الكربون في المذيبات الهيدروكربونية في مدي درجات الحرارة من ٢٨٨° كلفن إلي ٣٠٣ ° كلفن (√)

٦. السلوك المثالي للسوائل هو عبارة عن السلوك الذي تتساوي فيه جميع قوي التجاذب مابين المكونات وبعضها وبين السوائل النقية. (√)

٧. ذوبان الأكسجين في الماء يتبع قانون هنري للذوبانية الغازات في السوائل. (√)

٨. ينطبق قانون راؤولت علي السوائل العديمة الإمتزاج (X)

٩. المحاليل هي مخاليط متجانسة وتكون نسب مكوناتها متغيرة وبذلك تختلف عن المركب الكيميائي (√)

١٠. كلا من الغازات الأتية شره الذوبان في الماء غاز كلوريد الهيدروجين ، النشادر ،ثاني أكسيد الكبريت (√)

١١. مثال علي الحيود الموجب خليط الكلوروفورم و الأسيتون. (X)

١٢. للحصول علي محاليل من النوع صلب في صلب لابد أولا من تحويل المادة الصلبة إلي سائلة عن طريق الذوبان في الماء مثل جميع السبائك (X)

١٣. في الحيود الموجب عن قانون راؤولت يزداد الحجم والضغط وتزداد درجة الحرارة. (√)

١٤. في الحيود الموجب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أكبر من قوي التجاذب بين جزيئات السائل النقي. (X)

١٥. الضغط البخاري للمحلول أكبر من الضغط البخاري للسائل النقي. (√)

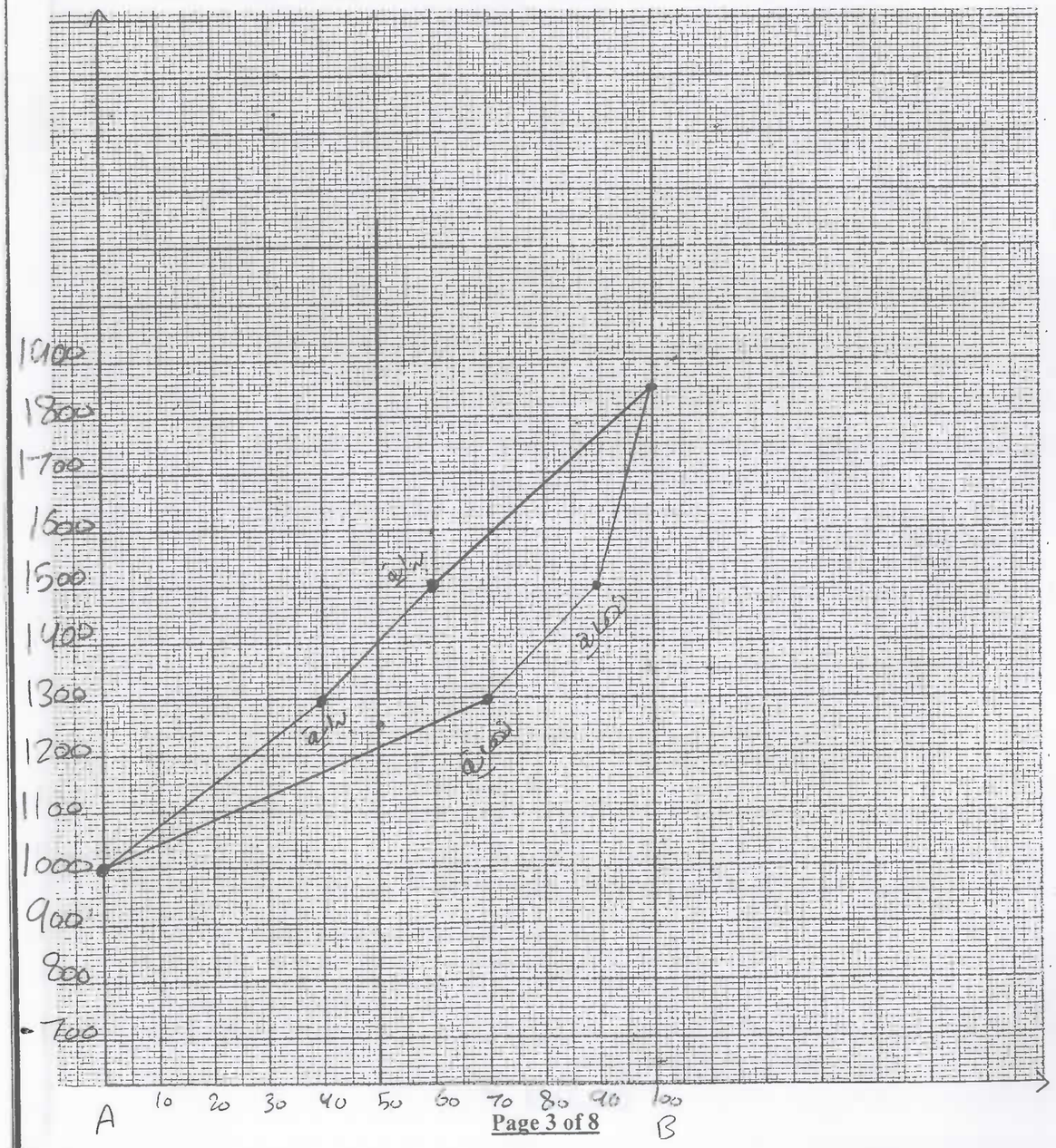
١٦. في الحيود السالب عن قانون راؤولت يقل الحجم والضغط وتقل درجة الحرارة. (√)

١٧. إتحاد أكسيد الكالسيوم مع ثاني أكسيد الكربون إحدي صور ذوبان المادة الصلبة في الغازات (X)

١٨. بزيادة مساحة السطح تقل عملية الإدمصاص (X)

١٩. في الحيود السالب يحدث تنافر بين جزيئات المحلول وتكون قوي التجاذب بين جزيئات المحلول أقل من قوي التجاذب بين جزيئات السائل النقي (X)

End of first part of questions .....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إيمان محمد علوان
302

Tanta University — Physical and Mathematical Engineering Department — Faculty of Engineering

Course Title	Engineering Chemistry	Final Exam	Course Code	PME0104
Date	17/1/2022	Model no. CLM253	Allowed time	3 hours

Part two :Answer the following questions in the electronic sheet

25. Which of these processes is *endothermic*?
A. $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$ B. $H_2O(g) \rightarrow H_2O(l)$
C. $3O_2(g) + 2CH_3OH(g) \rightarrow 2CO_2(g) + 2H_2O(g)$ (D) $H_2O(s) \rightarrow H_2O(l)$

26. An endothermic reaction causes the surroundings to
A. warm up. B. become acidic. C. condense. (D) decrease in temperature.

27. Which of the following processes *always* results in an increase in the energy of a system?
A. The system loses heat and does work on the surroundings.
(B) The system gains heat and does work on the surroundings.
C. The system loses heat and has work done on it by the surroundings.
D. The system gains heat and has work done on it by the surroundings.
E. None of these is always true.

28. A gas is compressed in a cylinder from a volume of 20 L to 2.0 L by a constant pressure of 10.0 atm. Calculate the amount of work done on the system.
A. 1.01×10^4 J B. -180 J C. 1.84×10^4 J D. -1.81×10^4 J E. 180J

29. According to the first law of thermodynamics:
A. Energy is neither lost nor gained in any energy transformations.
B. Perpetual motion is possible.
(C) Energy is conserved in quality but not in quantity.
D. Energy is being created as time passes. We have more energy in the universe now than when time began.

30. An exothermic reaction causes the surroundings to
(A) warm up. B. become acidic. C. expand. D. decrease its temperature

31. 4. A sample of nitrogen gas has a volume of 32.4 L at 20°C. The gas is heated to 220°C at constant pressure. What is the final volume of nitrogen?
A. 2.94 L B. 19.3 L C. 31.4 L D. 54.5 L E. 356 L

32. A sample of N_2 gas occupies 2.40 L at 20°C. If the gas is in a container that can contract or expand at constant pressure, at what temperature will the N_2 occupy 4.80 L?
A. 10°C B. 40°C C. 146°C D. 313°C E. 685°C

33. If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?
A. 8 B. 2 C. 1/2 D. 1/4 E. 1/8

Tanta University — Physical and Mathematical Engineering Department — Faculty of Engineering

34. A mixture of gases contains 4.46 moles of neaon (Ne) . 0.74 mole of argon (Ar) and 2.15 moles of xenon (Xe) .Calculate the partial pressures of the argon (Ar) gas if the total pressure is 2.00 atm at a certain temperature.
[a] 0.10 atm [b] 0.586 atm [c] 0.20 atm [d] 1.21 atm

35.Calculate the number of liters of carbon dioxide measured at STP that could be produced from 7.45 g of propane.
A) 1.90 L CO2 B) 3.80 L CO2 C)12.5 L CO2 D)11.4 L CO2

36. Samples of the following volatile liquids are opened simultaneously at one end of a room. If you are standing at the opposite end of this room, which species would you smell first?[Assume that your nose is equally sensitive to all these species. a. ethyl acetate ($CH_3COOC_2H_5$) b. camphor ($C_{10}H_{16}O$)
c. naphthalene ($C_{10}H_8$) . d. diethyl ether ($C_2H_5OC_2H_5$)

37. The unit(s) of free energy change $\Delta G°$ is(are) .
A. J·mol–1 B. J C. J·mol–1·K–1 D. J·K·mol–1

38. During the interaction between the system and the surrounding the amount of energy gained by the system must be exactly equal to the amount of energy lost the surrounding .
a. First law of thermodynamic b. Second law of thermodynamic
c. Third law of thermodynamic d . Zero law of thermodynamic

39. They are related to the molecular structure of a system and the degree of the molecular activity. . a. microscopic form of energy. b .a macroscopic form of energy.
c. Chemical energy. d. a&c

40. Greater value of standard reduction potential greater will be tendency
A.to get oxidized B. to get reduced C. accept electrons D. both b and c

41.The half cells are interconnected through. A.Wire B. salt bridge C. electric circuit D. no connection exists

42. What is $\Delta G°$ per mole of dichromate ions for the reduction of dichromate ions, $Cr_2O_7^{2-}$, to Cr^{3+} by bromide ions, Br^-, in acidic solution in galvanic cell? (Hint: Use the standard cell potential.)
(a) +26.3 kJ (b) -158 kJ (c) +158 kJ (d) -26.3 kJ

43. The amount of heat required to rise the temperature of 1lbm of distilled water 1^0F
a-Specific heat b- Btu c- Calory d- Heat capacity

44. The total entropy of a mixture of gases is the ____ of the partial entropies.
a) average b) weighted mean c) sum d) difference of the highest and the lowest

45. The Chemical Composition of a sample of cement are as the following: (loss 0.81% , SO_3 2.37% , MgO 0.79% , Fe_2O_3 3.11% , Al_2O_3 4.74% , SiO_2 23.44% , CaO 64.74%). Calculate the weight % of the following compounds :the Silica modulus equal____ A. 1 B. 1.52 C. 2.07 D. 2.99

46. From the previous problem (45) calculate the alumina modulus ?
A. 1.52 B.1 C. 2.99 D. 2.07

47. From the problem no.(45) calculate the hydraulic modulus ?
A. 1 B. 2.99 C.1.52 D. 207 2.069

48. Lime Stone is one from Raw materials used in the manufacture of cement: which is consider as a source
of..... A. Al_2O_3 B. Al_2O_3 & SiO_2 C. CaO D. SiO_2

49. As the cell given below operates, the strip of silver gains mass (only silver) and the concentration of silver ions in the solution around the silver strip decreases, while the strip of lead loses mass and the concentration of lead increases in the solution around the lead strip. Which of the following represents the reaction that occurs at the negative electrode in the above cell?
$Pb / Pb(NO_3)_2$ (1.0 M) || $AgNO_3$ (1.0 M) / Ag
(a) $Pb^{2+} + 2\,e^-$ ▒▒ Pb ×
(b) Pb ▒▒ $Pb^{2+} + 2\,e^-$
(c) $Ag^+ + e^-$ ▒▒ Ag
(d) Ag ▒▒ $Ag^+ + e^-$ ×
Pb/Pb^{+2} (1M) // $2Ag^+$ (1M) / 2Ag
$Pb + 2Ag^+ \longrightarrow Pb^{+2} + 2Ag$

50. . For a voltaic (or galvanic) cell using Ag,Ag^+ (1.0 M) and Zn^{2+} (1.0 M) ,Zn half-cells, which of the following statements is **incorrect**?
(a) The zinc electrode is the anode.
(b) Electrons will flow through the external circuit from the zinc electrode to the silver electrode
(c) Reduction occurs at the zinc electrode as the cell operates.
(d) The mass of the zinc electrode will decrease as the cell operates.

51. Consider the standard voltaic (or galvanic) cell: Fe,Fe^{2+} versus Au,Au^{3+}. Which answer identifies the cathode and gives the E° for the cell?
(a) Fe, -0.44 V (b) Au, 1.96 V (c) Fe, 1.06 V (d) Au, 1.08 V

52. What is the reduction potential for the half-reaction at 25° C:
$Al^{3+} + 3e^-$ ▒▒ Al , if $[Al^{3+}] = 0.10$ M and E° = -1.66 V ?
(a) -1.84 V (b) -1.60 V (c) -1.68 V (d) -1.66 V
$E_{cell} = E^\circ_{cell} - \frac{RT}{nF}\ln k$
$E_{cell} = -1.66 - \frac{8.314 \times (25+273)}{3 \times 96500} \ln \frac{1}{0.1}$

53. Calculate the potential (in volts) for the voltaic (or galvanic) cell indicated at 25°C.
Ga / Ga^{3+} (10^{-6} M) || Ag^+ (10^{-4} M) / Ag
(a) 1.29 V (b) 0.97 V (c) 1.45 V (d) 1.23 V
$E^\circ_{cell} = 1.3596$
$1.3596 - \frac{0.059}{3} \log \frac{10^{-6}}{10^{-4}}$

54. Sand added to adjust the composition of the mixture used in the manufacture of cement t reach % SiO2 =.....in the Cement. A. 11% B. 21 % C.22% D. 12%

55. The choose of the suitable method for the production of cement depends on.....
a. type of the raw materials b. the availability of the fuel. c. quality of the raw materials
d.All the previous

56. If the amount of Al_2O_3 ....., the burning of cement will occur at .....temperatur and the produced cement will be fast –hardening .
A. decreases -high B. increases -high C. increases -low D. decreases -low

57. If carbon dioxide molecules effuse at an average rate of 5 mol/s, at what rate would diatomic

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$
$\frac{5}{} = \sqrt{\frac{2}{}}$
$CO_2 \longrightarrow 5$
$H_2 \longrightarrow ?$

hydrogen molecules effuse in the exact same conditions?
a) 23.5 mol/s b) 4.7 mol/s c)110 mol/s d)Not enough information is provided

58. Choose the substance with the higher entropy per mole at a given temperature: $CO_2(g)$ *or* $CO_2(aq)$.
a. $CO_2(g)$. b. $CO_2(g)$ & $CO_2(aq)$. C. CO2(s). D. $CO_2(aq)$

59. Consider an electrochemical cell constructed from the following half cells, linked by an external circuit and by a KCl salt bridge. • an Al(s) electrode(anode) in 1.0 M $Al(NO_3)_3$ solution
$Al \longrightarrow Al^{+3} + 3e^-$ ×2
• a Pb(s) electrode(cathode) in 1.0 M $Pb(NO_3)_2$ solution. The balanced overall (net) cell reaction is
$Pb^{+2} + 2e^- \longrightarrow Pb$ ×3
A. $Pb(s) + Al^{3+}(aq) \rightarrow Pb^{2+}(aq) + Al(s)$. B. $3Pb(s) + 2Al^{3+}(aq) \rightarrow 3Pb^{2+}(aq) + 2Al(s)$.
C. $3Pb^{2+}(aq) + 2Al(s) \rightarrow 3Pb(s) + 2Al^{3+}(aq)$. D. $Pb^{2+}(aq) + Al(s) \rightarrow Pb(s) + Al^{3+}(aq)$.

60. Consider an electrochemical cell based on the following cell diagram:
$Pt \mid Pu^{3+}(aq), Pu^{4+}(aq) \parallel Cl_2(g), Cl^-(aq) \mid Pt$
0.35 - 1.36 = - red Pu
Given that the standard cell emf is 0.35 V and that the standard reduction potential of chlorine is 1.36 V, what is the standard reduction potential $E^\circ(Pu^{4+}/Pu^{3+})$? A.2.37 V
B.1.01 V C. -1.71 V D. -1.01 V

Question(2): .....

Write (√) for the true statement and write (x) for the false sentence in the answer sheet

20. The important factors which may influence the corrosion process are: Nature of the metal, nature of the environment and the corrosion products & Temperature only.....(X)
21. Inhibitors: They are Chemical substances added to the corrosive solution in a small amount (e.g.0.3%).....(X)
22. Passivators , such as hydrazine (N2H4) these substances takes O_2 from the corrosive solution.....(√)
23. Anodic inhibitors are substances such as Na_2CO_3 that react with the anodically formed Fe ions to form insoluble iron carbonate which deposit on the anode and isolate it from the corrosive medium.....(√)
24. Cathodic protection of underground steel pipeline is carried out (externally using less Nobel galvanic anode (galvanic cell) Zn or Mg rod .....(√)
25. Presence of differential aeration oxygenation cells takes place due to the difference in the porosity of the concrete , This is the most common reason which causing Corrosion of Steel Reinforcement in Concrete.....(√)
26. Dissimilar metal corrosion cells are set up when two different metals become in contact with each other in the presence of an electrolyte .....(√)
27. The less Nobel metals acts as the anode and the more Nobel metals acts as the cathode where H2 evaluation takes place in the electrochemical cell .....(√)
28. Differential aeration (oxygenation)cells: This type of corrosion cells takes place whenever there is a difference in the dissolved O2 conc. Where O_2poor area acts as the anode and the O2 rich area act as the cathode.....(√)

29. .Chemical corrosion takes place due to direct attack by acids or alkalis..... (✓)
30. Metals above H_2 in the e.m.s do not dissolve in acids (known by Nobel metals)because it is difficult to loss their electrons and difficult to convert into ions..... (✗)
31. Temporary Coating (coating with lubricating oil or Vaseline which removed easily by an organic solvent .....(✓)
32. coating with less Nobel metal(must be free from cracks or pores)like Zn..... .(✗)
33. Presence of dissimilar metal corrosion cell is the most common reason which causing Corrosion of Steel of Reinforcement in Concrete..... (✗)
34. Temporary Coating is not one of the Methods of protecting metals against corrosion……..(✓)
35. In the metallic coating : Coating with more Nobel metal must be free from cracks or pores (like Cu)…… …… .(✓)
36. The passive layer formed on the reinforcement steel is a Layer of the iron oxides and hydroxides formed on the reinforcement steel as a result of exposing it to the atmospheric oxygen……(✓)
37. If the amount of calcium increases in the mixture too much during the production of cement , The cement damaged and exposed to cracking..... (✓)
38. Reactions inside the rotary kiln (furnace) , Part of Iron oxide reacts with Al_2O_3 and CaO to form C4AF..... (✗)
39. The compounds which are responsible for final strength of Cement is Tricalcium silicate & Tricalcium Aluminate..... (✗) C3S, C3A
40. Irreversible reactions are the reactions that occur in both directions, forward and backward, so both reactant and products are always found in solution and can combine again. ..... . (x)
41. The critical temperature in the pressure – volume diagram Upon which are drawn isothermal of CO curves is 31 °C .....(✗)
42. Although effusion differs from diffusion in nature , the rate of effusion of a gas has the same form as Graham,s law of diffusion .....(√)
43. The few amounts of hardness remain in water after water treatment processes , it activates the corrosion problems..... (✓)
44. The one-day strength of this cement is equal to the three-day strength of OPC with the same water-cement ratio, It is the High rapaid cement..... (✓)
45. It is produced from the burning from the lime stone and Bauxite as a source of Aluminium oxides, it is Sea water Cement..... (✗)
46. Increasing the permeability of the concrete will allow to the carbon dioxide from air and chloride from solution to penetrate to the steel and decrease the pH..... (√)
47. Adiabatic changes mean that: It is the process in which the system does not gain or loss heat . It is closed system..... (✓)
48. Kelvin – Planck statement of second law of thermodynamic: (No heat engine can have

thermal efficiency100%)..... (✓)
49. For a given substance the entropy always increases in the following order: S (solid) < S (liq) < S(gas). ..... (✓)
50. The critical temperature for carbon dioxide is 304 K. That means that no amount of pressure applied to a sample of carbon dioxide gas at or above 304K..... (✗)
51. Gas Effusion is a direct demonstration of gaseous random motion is provided by diffusion , the gradual mixing of molecules of one gas with molecules of another by virtue of their kinetic properties. ..... (✓)
52. When the combustion be incomplete :- part of carbon converted to carbon dioxide and the rest to carbon monoxide , all hydrogen converted to water and all sulphur converted to sulphur dioxide .....(✗)
53. Atmospheric air consists of . 21% O_2 & 79% N_2 by weight..... (✗)
54. 2.5 moles of O_2 is added to 5 moles of H_2 , Number of moles of H_2O will it produce are 5 moles..... (✓) $\frac{1}{2}O_2 + H_2 \rightarrow H_2O$; $\frac{1}{2}$ 1 1 ; 2.5 5 5

End of questions ..... Best Wishes

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Reduction reaction of metal	Standard reduction potential : $E°$ (V)
$Au^+ + e^- \rightleftharpoons Au(s)$	1.83
$Au^{3+} + 2e^- \rightleftharpoons Au^+$	1.36
$Au^{3+} + 3e^- \rightleftharpoons Au(s)$	1.52 ←
$AuCl_4^- + 3e^- \rightleftharpoons Au(s) + 4Cl^-$	1.002
$Fe^{2+} + 2e^- \rightleftharpoons Fe(s)$	−0.44 ←
$Fe^{3+} + 3e^- \rightleftharpoons Fe(s)$	−0.037
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	0.771
$Mn^{2+} + 2e^- \rightleftharpoons Mn(s)$	−1.17
$Mn^{3+} + e^- \rightleftharpoons Mn^{2+}$	1.5
$MnO_2(s) + 4H^+ + 2e^- \rightleftharpoons Mn^{2+} + 2H_2O(l)$	1.23
$MnO_2(s) + 4H^+ + e^- \rightleftharpoons Mn^{3+}(aq) + H_2O(l)$	0.95
$MnO_4^- + 4H^+ + 3e^- \rightleftharpoons MnO_2(s) + 2H_2O(l)$	1.70
$MnO_4^- + 8H^+ + 5e^- \rightleftharpoons Mn^{2+} + 4H_2O(l)$	1.51
$Ag^+ + e^- \rightleftharpoons Ag(s)$	0.7996 ←
$AgBr(s) + e^- \rightleftharpoons Ag(s) + Br^-$	0.071
$Ag_2C_2O_4(s) + 2e^- \rightleftharpoons 2Ag(s) + C_2O_4^{2-}$	0.47
$Ga^{3+} + 3e^- \rightleftharpoons Ga(s)$	-0.56 ←
$Cu^+ + e^- \rightleftharpoons Cu(s)$	0.520
$Cu^{2+} + e^- \rightleftharpoons Cu^+$	0.159
$Cu^{2+} + 2e^- \rightleftharpoons Cu(s)$	0.3419
$Br_2 + 2e^- \rightleftharpoons 2Br^-$	1.087 →
$HOBr + H^+ + 2e^- \rightleftharpoons Br^- + H_2O(l)$	1.341
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	−0.424
$Cr^{2+} + 2e^- \rightleftharpoons Cr(s)$	−0.90
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightleftharpoons 2Cr^{3+} + 7H_2O(l)$	1.36 →
$Mg^{2+} + 2e^- \rightleftharpoons Mg(s)$	−2.356
$Mg(OH)_2(s) + 2e^- \rightleftharpoons Mg(s) + 2OH^-$	−2.687
$Al^{3+} + 3e^- \rightleftharpoons Al(s)$	−1.676
$Al(OH)_4^- + 3e^- \rightleftharpoons Al(s) + 4OH^-$	−2.310 ←
Zn	-0.76
Cu	+0.34