



Note: Answer only four questions.

Q1/

A- A vertical cylinder of diameter 180 mm rotates concentrically inside another cylinder of diameter 181.2 mm. Both the cylinders are 300 mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. Determine the viscosity of the fluid if a torque of 20 Nm is required to rotate the inner cylinder at 120 rpm.

(5-mark)

B- Anthracite coal, density 1506 kg/m^3 , is to be fluidized with air at 1.379 bar and 450°C in a vessel 3.048 m ID. 15 tons of powder coal of an average diameter 200 microns, are placed in the vessel, which is filled to a height of 2.13 m. Compute (a) the static void fraction e_0 , (b) the minimum void fraction e_{mf} and bed height for fluidization L_{mf} , (c) the minimum velocity for fluidization, (d) the minimum pressure drop for fluidization, (e) the minimum velocity for particle transport. Take that $e_{mf} = 1 - 0.356[(\log d_p) - 1]$, d_p in microns, The dynamic viscosity of air at 450°C is $3.431 \times 10^{-5} \text{ Pa.s}$.

(7.5-mark)

Q2/

A- The power developed by water turbine P depends upon the following variables:

- Working head (H) - impeller diameter (D) - rotational speed (N)
- Width of mover (B) - Fluid density (ρ) - Fluid dynamic viscosity (μ)
- acceleration of gravity (g)

From a dimensional analysis, use appropriate method; obtain a relation between the Power and these variables.

(5-mark)

B- A reservoir 100 m long and 100 m wide is provided with a rectangular notch 2m long. Find the time required to lower the water level in the reservoir from 2 m to 1 m above the base of the notch. $C_d = 0.6$.

(7.5-mark)

Q3/

A- For power-law fluids, flow through a circular pipe, the relation between shear stress (τ_{rx}) and shear rate ($\dot{\gamma}$) is: $\tau_{rx} = k(-\dot{\gamma})^n = k(-du_x/dr)^n$ show that: $u_x = u_{max}[1-(r/R)^{n+1/n}]$, where u_{max} is the velocity at the centerline $u_{max} = n/(n+1) R^{n+1/n} [(-\Delta P)_f / (2kL)]^{1/n}$, and k: flow consistency coefficient, n: flow behavior index, u_x : velocity at r in x-direction, r: distance from the centerline, R: radius of the pipe, $(-\Delta P)_f$: pressure drop due to skin friction, and L: pipe length.

(5-mark)

B- Oil of viscosity 10 mNs/m^2 and specific gravity 0.90, flows through 60 m of 100 mm diameter pipe and the pressure drop is 13.8 kN/m^2 . What will be the pressure drop for a second oil of viscosity 30 mNs/m^2 and specific gravity 0.95 flowing at the same rate through the pipe? Assume the pipe wall to be smooth.

(7.5-mark)

Q4/

A- Begin from velocity distribution of Newtonian fluid in laminar flow through circular pipe $u_x = u_{max}[1-(r/R)^2]$, show that $f = 16/Re$, where $u_{max} = [(-\Delta P)_f d^2 / (16 L \mu)]$.

(5-mark)

B- A centrifugal pump used to take water from reservoir to another through 800 m length and 0.15 m i.d. if the difference in level of the two tanks is 8 m, calculate the flow rate of the water and the power required, assume $f = 0.004$.

Q (m ³ /h)	0	23	46	69	92	115
Δh (m)	17	16	13.5	10.5	6.6	2.0
η	0	0.495	0.61	0.63	0.53	0.1

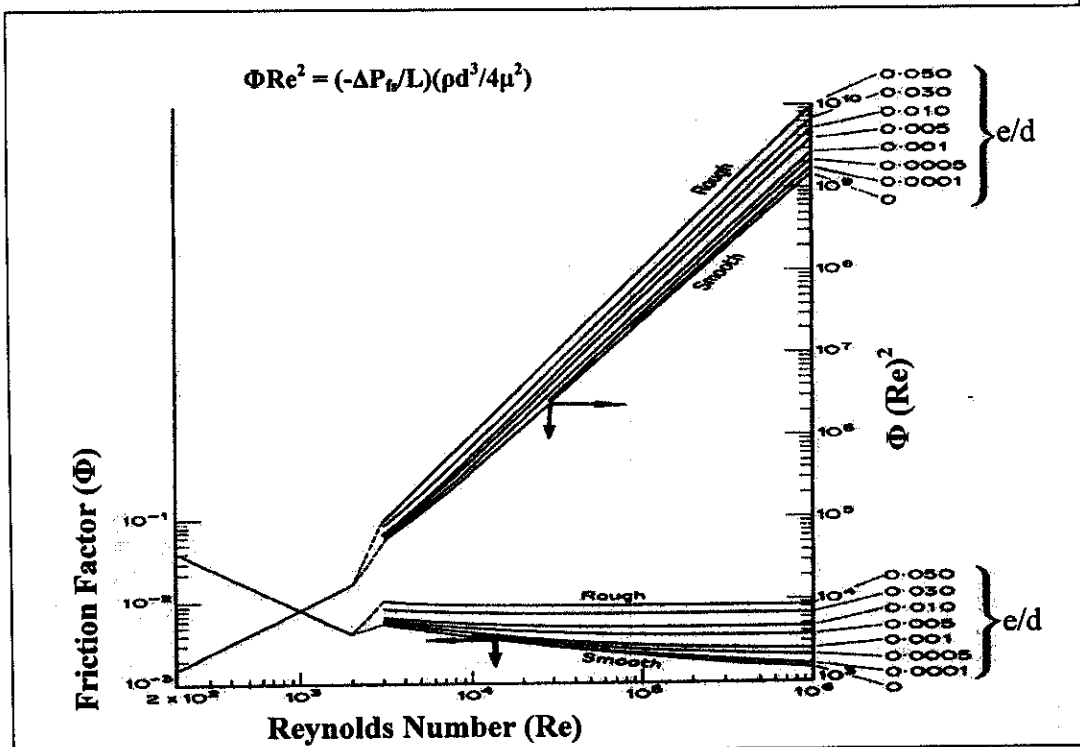
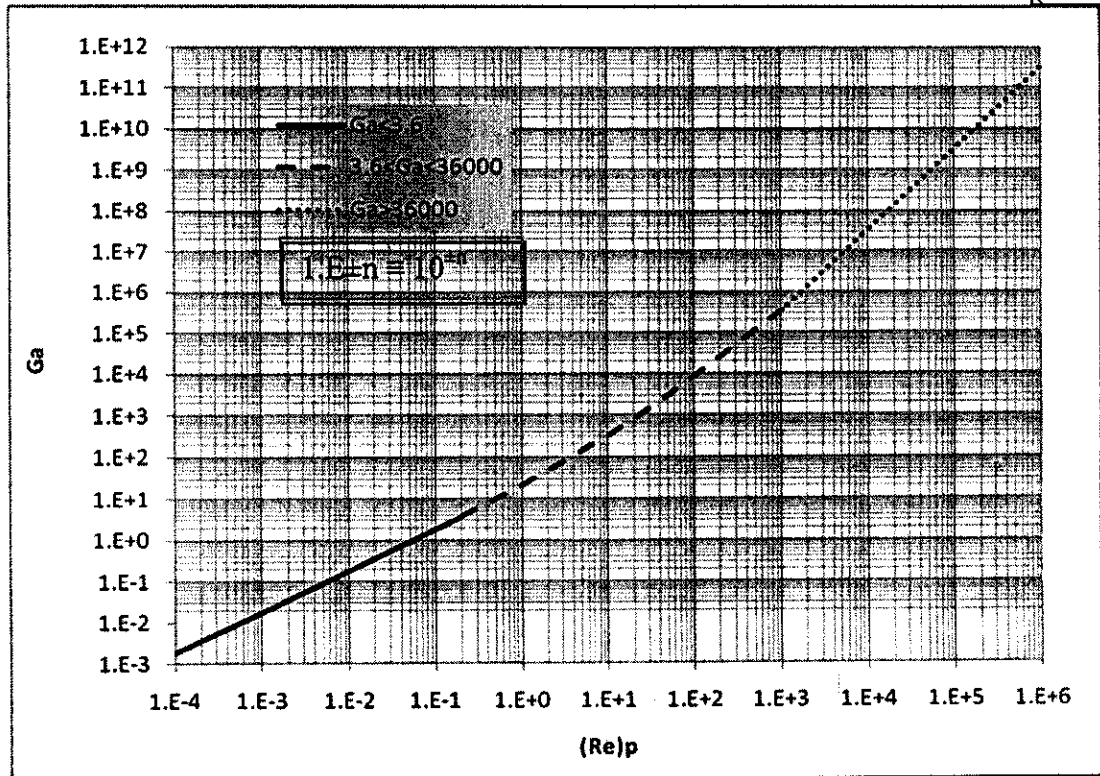
(7.5-mark)

Follow \uparrow

Q5/

A- Explain how the power of Froude number (γ) in liquid mixing could be determined experimentally. (5-mark)

B- A flow of $50 \text{ m}^3/\text{s}$ methane, measured at 288 K and 101.3 kPa has to be delivered along a 0.6 m diameter line, 3 km long a relative roughness $e = 0.0001 \text{ m}$ linking a compressor and a processing unit. The methane is to be discharged at the plant at 288 K and 170 kPa , and it leaves the compressor at 297 K . What pressure must be developed at the compressor in order to achieve this flow rate? Take that μ_{CH_4} at $293 \text{ K} = 0.01 \times 10^{-3} \text{ Pa.s}$ (7.5-mark)



GOOD LUCK



PART (A)

Q1- Fill in the blank (Answer Ten only):-

1. Macroscopic defects are called -----
2. Atoms have higher diffusion coefficient in ----iron than in -----iron.
3. -----hardness can be related to strength of metals and alloys.
4. Interfacial imperfections occur over -----
5. The mass of an atom which has atomic weight of 52amu, is equal to-----
6. The Fe-Fe₃C eutectoid temperature is -----The Fe-Fe₃C eutectoid composition is -----% C.
7. The -----strength is the stress calculated as maximum load per unit of -----area.
8. In steels,-----is FCC and ----- is Bcc.
9. A crystal direction and its multiple are-----
10. -----is larger than its corresponding atom.
11. -----is a lamellar mixture of -----
12. A material having large bounding energy have high-----.

(20marks)

Q2- Answer Two of the following:-

1. List and sketch the types of point defects.
2. Define and give an example of Two of the following:- Composite materials, Close-packed direction, Allotropic material
3. What are the types of solid solution and what are the difference between them.

(20marks)

Q3- Consider a Cu-40% Ag alloy. Determine:-

1. If the alloy is hypoeutectic or hypereutectic.
2. The composition of the first solid to form during solidification.
3. The amounts and compositions of each phase at 780°C.
4. The amounts and compositions of each phase at 778°C.
5. The amounts of eutectic and primary α at 778°C.

(20marks)

PART (B) Answer Two of the following questions

Q4-What temperature is required to obtain 0.5% C at a distance of 0.5mm beneath the surface of a 0.2% C steel in 2 hour, when 1.1% C is present at the surface? Assume that the iron is FCC. $D_0=0.23 \text{ cm}^2/\text{sec}$ and $Q_d=32900 \text{ cal/mole}$.

(20marks)

Q5- A cylindrical specimen of steel having an original diameter of 12.8mm is tensile tested to fracture and found to have an engineering fracture strength of 460Mpa. If its cross-sectional diameter at fracture is 10.7mm, determine:-

- a-The ductility in term of reduction in area.
- b-The true stress and true strain at fracture.

(20marks)

Q6- Above 882°C, titanium has a BCC crystal structure, with $a=0.332\text{nm}$. Below this temperature titanium has a HCP structure (Hexagonal close-packed structure) with $a=0.2978\text{nm}$ and $c=0.4735\text{nm}$. Determine:-

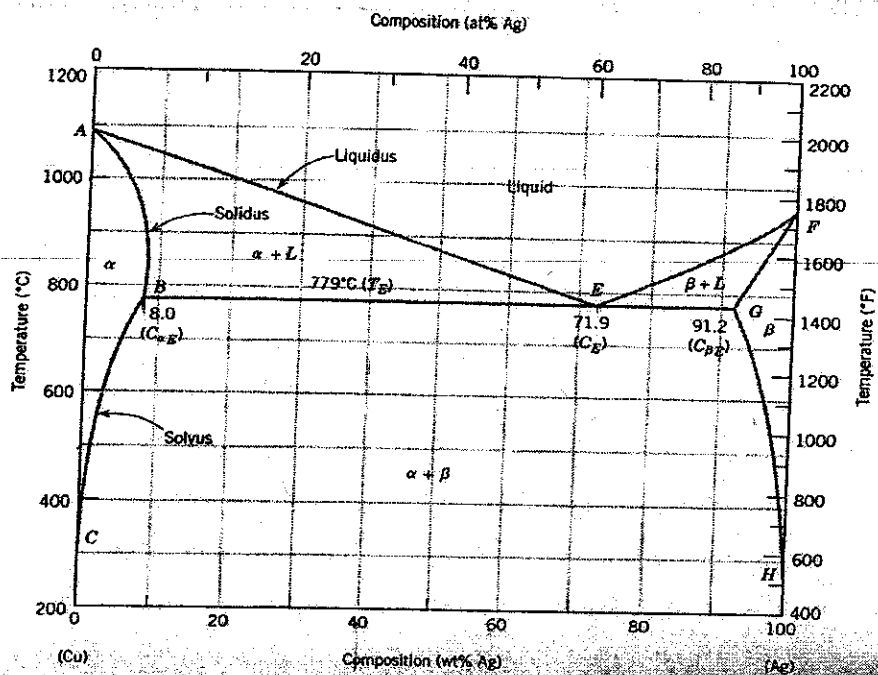
- a- The percent volume change when BCC titanium transforms to HCP titanium. Is this a contraction or expansion.
 - b- The percent density change when BCC titanium transforms to HCP titanium.
- Atomic weight of titanium=47.88 g/mole,

(20marks)

Good-Luck

Table 5.1 Tabulation of Error Function Values

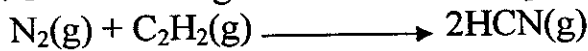
z	$\text{erf}(z)$	z	$\text{erf}(z)$	z	$\text{erf}(z)$
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999





Note: Answer four questions only.

Q1: The following reaction reaches equilibrium at 600°C and atmospheric pressure:



If the system initially is an equimolar mixture of nitrogen and acetylene.

1) What is the equilibrium constant of the reaction?

2) what is the composition of the system at equilibrium? Assume ideal gases.

component	A	10 ³ B	10 ⁻⁵ D	$\Delta H_{f,298}$ (J/mol)	$\Delta G_{f,298}$ (J/mol)
N ₂	3.28	0.593	0.04	-	-
C ₂ H ₂	1.952	0.557	-1.299	227480	209970
HCN	1.359	0.422	-0.725	135100	124700

(15mark)

Q2: From the first law of thermodynamics derive:

$$\text{a) } \frac{|Q_H|}{|Q_C|} = \frac{T_H}{T_C}$$

(7.5 mark)

$$\text{b) } \frac{T_2}{T_1} = \left[\frac{P_2}{P_1} \right]^{(\gamma-1)/\gamma}$$

(7.5 mark)

Q3: A/ Steam at (475 Kpa)and (200 °C) expands at constant enthalpy (as in throttling process) to (350 Kpa). What is the temperature of the steam in its final state and what is its entropy change?. $c_p^v = 2.1 \text{ kJ/ k.}$

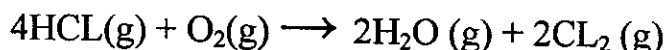
(7.5 mark)

		(TEMPERATURE: T kelvins) (TEMPERATURE: t °C)									
P/kPa	sat.	sat.	423.15	448.15	473.15	493.15	513.15	533.15	553.15	573.15	
T ^{sat} /K (t ^{sat} /°C)	liq.	vap.	(150)	(175)	(200)	(220)	(240)	(260)	(280)	(300)	
	V	1.079	524.00	540.68	576.90	612.31	640.18	667.75	695.08	722.27	749.33
350	U	583.892	2548.2	2567.1	2608.3	2648.6	2680.4	2712.0	2743.4	2774.8	2806.2
412.02(138.87)	H	584.270	2731.8	2758.3	2810.3	2863.0	2904.5	2945.7	2986.7	3027.6	3068.4
	S	1.7273	6.9392	6.9982	7.1222	7.2386	7.3226	7.4045	7.4828	7.5581	7.6307
	V	1.081	491.13	503.29	537.46	570.89	596.81	622.82	648.22	673.64	698.94
375	U	594.332	2550.6	2565.4	2607.1	2647.7	2679.5	2711.3	2742.8	2774.3	2805.7
414.48(141.31)	H	594.737	2734.7	2764.1	2808.6	2861.7	2903.4	2944.8	2985.9	3026.0	3067.8
	S	1.7526	6.9160	6.9624	7.0875	7.2027	7.2891	7.3713	7.4499	7.5254	7.5981
	V	1.084	462.22	470.86	502.93	534.26	558.85	583.14	607.20	631.09	654.85
400	U	604.237	2552.7	2563.7	2605.8	2646.7	2678.8	2710.6	2742.2	2773.7	2805.3
416.17(143.62)	H	604.870	2737.6	2752.0	2807.0	2860.4	2902.3	2943.9	2985.1	3026.2	3067.2
	S	1.7764	6.8943	6.9265	7.0548	7.1708	7.2576	7.3402	7.4190	7.4947	7.5675
	V	1.086	436.61	441.85	472.47	502.12	526.36	548.30	571.01	593.54	615.95
425	U	613.667	2554.8	2562.0	2604.5	2645.7	2678.0	2709.9	2741.6	2773.2	2804.8
418.97(145.82)	H	614.128	2740.3	2749.8	2805.3	2858.1	2901.2	2942.9	2984.3	3025.5	3066.6
	S	1.7990	6.8739	6.8965	7.0239	7.1407	7.2290	7.3106	7.3899	7.4657	7.5388
	V	1.088	413.75	416.24	445.36	473.55	495.59	517.33	538.83	560.17	581.37
450	U	622.672	2556.7	2560.3	2603.2	2644.7	2677.1	2709.2	2741.0	2772.7	2804.4
421.07(147.92)	H	623.162	2742.9	2747.7	2803.7	2857.8	2900.2	2942.0	2983.5	3024.8	3066.0
	S	1.8204	6.8547	6.8660	6.9946	7.1121	7.1999	7.2831	7.3624	7.4384	7.5116
	V	1.091	393.22	393.31	421.14	447.97	468.95	489.62	510.05	530.30	550.43
475	U	631.294	2558.5	2558.6	2601.9	2643.7	2676.3	2708.5	2740.4	2772.2	2803.9
423.07(149.92)	H	631.812	2745.3	2745.5	2802.0	2856.5	2899.1	2941.1	2982.7	3024.1	3065.4
	S	1.8406	6.8385	6.8368	6.9667	7.0850	7.1732	7.2567	7.3363	7.4125	7.4858

B// : A rigid vessel of (0.05m^3) volume contains an ideal gas, $C_v=(5/2)R$ at 500K and 1 bar . If heat in the amount of (12000J) is transferred to the gas, determine its entropy change.

(7.5 mark)

Q4: Chlorine is produced by the reaction:



The feed stream to the reactor consists of (67mole percent **HCL**, 30 mole percent **O₂**, and (3mole percent **N₂**) and it enters the reactor at 500°C . If the conversion of **HCL** is 75percent and if the process is isothermal, how much heat must be transferred from the reactor per mole of the entering gas mixture?

component	$\Delta H^\circ_{f298}(\text{J/mol})$	$C_{p_{mh}}(\text{J/mol.K})$
HCL	-923.7	30.1954
O ₂	----	29.389
H ₂ O	-241818	34.702
CL ₂	----	33.7132

(15mark)

Q5: **A/** Water flows over a waterfall (100m) in height. Take (1Kg) of the water as the system, and assume that it does not exchange energy with its surroundings.

- What is the potential energy of the water at the top of the falls with respect to the base of the falls?
- What is the kinetic energy of the water just before it strikes bottom?
- After the (1Kg) of water enters the stream below the falls, what change has occurred in its state? $C_p \text{ water} = 4184 \text{ J/Kg.}^\circ\text{C}$.

(7.5 mark)

B// : Five kilograms of liquid carbon tetrachloride undergo a mechanically reversible isobaric change of state at (1bar) during which the temperature changes from $(0\text{ to }20)^\circ\text{C}$. Determine $\{\Delta V, W, Q, \Delta H \text{ \& } \Delta U\}$. The following properties for liquid carbon tetrachloride at (1bar & 0°C) may be assumed independent of temperature: $\beta = 1.2 \times 10^{-3} \text{ K}^{-1}$, $C_p = 0.84 \text{ kJ/Kg.K}$. The density at (0°C) & (1bar) is (1590 Kg/m^3) .

(7.5 mark)

$$R = 8.314 \text{ J/mol.K} = 83.14 \text{ bar.cm}^3/\text{mol.K}$$

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Note: Answer 4 questions only

Visual Basic

Q1 A: Answer by True or False only:

- The option value take either true or false.
- In Visual Basic programs, users can only input numbers, not text.
- Textboxes are used only to receive input from the user.
- The scrollbar can be used for values from 0 to 255 only.
- If then Else statement can be written in the form of a While loop to achieve the same logic and output.
- The ReDim statement in Visual Basic can be used to change the size of an array.
- The caption property used to display information in a text box.
- The first element of a Visual Basic array has zero as its index value.
- The command Val(n) Converts a string value to a number.
- The answer to $8 - 4 * 9$ is 36.

10 Marks

Q1 B: Write a program (design and code) which can be used as information source for Atomic weights of chemical elements with the following list of information.

chemical elements	H	He	Na	Al	Cl	O	Cr	Fe
Atomic Weights (gm/mol)	1.008	4.003	22.990	26.982	35.453	15.999	51.996	55.847

Note: Use Inputbox to enter the chemical element symbol.

15 Marks

Q2: Write a program (design and code) to calculate the bubble point for a mixture of six components. The vapor pressures of these components are calculated by the following Antoine equations:

$$P_i^o = \exp\left(A - \frac{B}{T + C}\right)$$

The constants of Antoine equation is given in table below

	A	B	C
Ammonia	16.9481	2132.50	-32.98
Benzene	15.9008	2788.51	-52.36
Acetone	16.6513	2940.46	-35.93
Methanol	18.5875	3626.55	-34.29
Ethanol	18.9119	3803.98	-41.68
Water	18.3036	3816.44	-46.13

$$K_i = P_i^o / P_t, \quad P_t = 760 \text{ mm hg}, \quad y_i = K_i \times x_i$$

Knowing at Bubble point: $\sum y_i = \sum K_i \times x_i = 1$

Note: use six textboxes to enter the mixture composition.

25 Marks

Matlab

Q3 A: Given the Matrix $A = [2 \ 7 \ 9 \ 7 ; 3 \ 1 \ 5 \ 6 ; 8 \ 1 \ 2 \ 5]$, explain the results of the following commands:

- size(A)
- sum(A)
- mean(A)
- A(:,1:3)
- A(2:3,3:-1:1)
- A(1,:).*A(2,:)
- A(1,:)+A(3,:)
- find(A>5)
- sort(A)
- min(min(A))

10 Marks

Q3 B: Data for the viscosity of molten solid as a function of temperature are given below table.

T (°C)	200	300	430	550
μ (Pa.s) $\times 10^4$	5.4	4.5	3.9	3.4

Write a program which uses the above data to determine the coefficient A , and B of the equation:

$$\mu = A \exp\left(\frac{B}{T}\right)$$

15 Marks

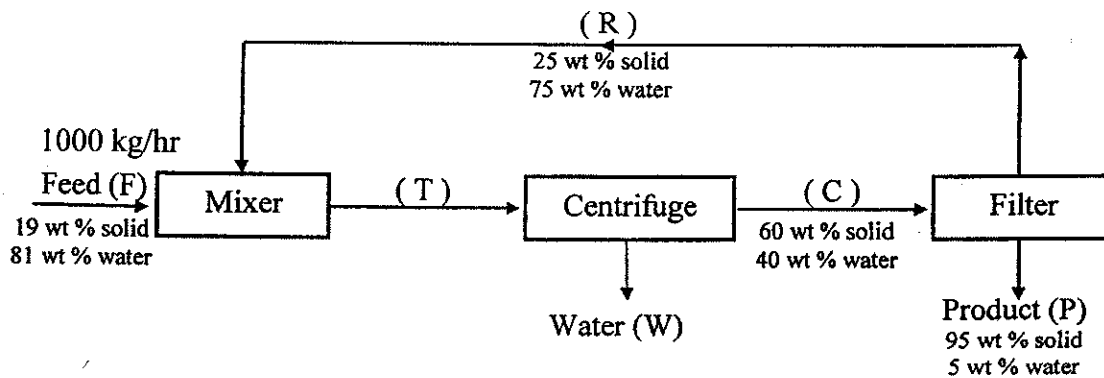
Q4 A: The average values of a function can be determined by $C_{p_{mh}} = \frac{\int_{T_1}^{T_2} C_p dT}{T_2 - T_1}$

Write Matlab code to verify the average value of specific heat of dry air in the range from 300 K to 450 K, C_p KJ/(Kg K), to temperature (K):

$$C_p = 0.99403 + 1.617 \times 10^{-4} T + 9.7215 \times 10^{-8} T^2 - 9.5838 \times 10^{-11} T^3 + 1.9520 \times 10^{-14} T^4$$

10 Marks

Q4 B: write a program to calculate the flow rates of streams W, P, C, R and T in the following flow diagram using matrix inverse method.



15 Marks

Q5 A: Rotameter calibration data (flow rate versus Rotameter reading) are as follows:

Flow rate V(L/min)	20	52.1	84.6	118.3	151
Rotameter Reading R	10	30	50	70	90

Write a Matlab code to:

- plot a calibration curve of rotameter reading versus flow rate.
- Use interpolation commands to calculate the flow rate that corresponds to a rotameter reading of 36.

10 Marks

Q5 B: The molar volume of a certain component at different pressures and temperatures are given in the table below:

T (°F)	130	160	190	220	250
P (psia)	V (ft ³ /lbmol)				
250	0.031	0.03265	0.03499	0.03525	0.03623
500	0.03066	0.03215	0.03421	0.03678	0.04112
1000	0.03009	0.03139	0.03300	0.03484	0.03730
1500	0.02966	0.03079	0.03212	0.03370	0.03529

Write a program to plot the results in three dimensional surface for molar volume versus temperature and pressure.

Note: add x-axis, y-axis, z-axis, and title labels to the figure.

15 Marks

GOOD LUCK



الإجابة على أربعة أسئلة فقط من ضمنها السؤال الأول

س1:- وقود سائل يحتوي على $C=84\%$, $H=12\%$, $O=1.5\%$, $S=2.5\%$ (نسبة وزنيه). تم حرقه في فرن احتراقاً تاماً مع 50% هواء زائد (Excess air). احسب: (1) حجم الهواء النظري اللازم للاحتراق التام (Theoretical air) / كغم وقود (2) النسبة المئوية الحجمية للغاز العادم الجاف (Orsat Analysis).
المعطيات:- الوزن الذري: $C=12$, $H=1$, $N=14$, $O=16$, $S=32$

(14 درجة)

س2:- (أ) اكمل ما يأتي :

- 1- أن من أهم العوامل التي تساعد على عملية الامتصاص في تجفيف الغاز الطبيعي _____ و _____ و _____
- 2- تتميز المواد التي تضاف إلى البترول لمنع تكوين المستحلبات بالصفات التالية _____ و _____ و _____
- 3- تتصف الحرارية المستخدمة في تبطين الأفران والمراجل البخارية والمواقد بما يلي _____ و _____ و _____
- 4- تعتبر المصادر العضوية أحد أصناف الطاقة وهي _____

(ب) اجب عن اثنين مما يلي بالتفصيل :

- 1- ما هي المعالجات المستخدمة عند تسيل الغاز الطبيعي؟
- 2- أن اختيار نسبة الراجع (Reflux) الملائمة إلى برج التقطير يتطلب دراسة وموازنة دقيقة. وضح ذلك بالتفصيل.
- 3- ماهي أهم الدلائل التشغيلية للأفران الأنبوبية؟

(12 درجة)

س3:- (أ) علل ما يأتي:

- 1- تعتبر القيمة الحرارية لفحم الكوك الحرارة العالية أوطا قليلاً من فحم الكوك الحرارة الواطئة.
- 2- تتم عملية احتراق الوقود السائل في المحارق أما بالحالة الغازية أو على شكل بخار.
- 3- من الضروري معرفة تركيب الرماد المكون عند حرق وقود زيت الوقود.
- 4- يجب أن يكون ماء التغذية للمرجل البخاري خالي من الشوائب.

(ب) احسب درجة الانبيلين (درجة مئوية) لوقود الديزل في محركات سريعة الحركة ذو وزن نوعي (0.83) ومعامل ديزل (53). ما علاقة معامل الديزل بالعدد السيتاني؟

(12 درجة)

س4:- (أ) اجب بصح أو خطأ مع تصحيح الخطأ أن وجد :

- 1- يتميز الأيزو اوكتان بقابليته العالية للفرقة.
- 2- تستخدم الأبراج ذات الحشو في تقطير البترول.
- 3- تمثل النسبة المئوية للهيدروجين الناتج من كربينه الفحم في درجات الحرارة العالية 20%.
- 4- يستعمل غاز الميثان لتسخين الأفران الخاصة بعملية الكربنة.

(ب) اشرح مايلي بصورة مختصرة:

- 1- كيف يتم تعيين المواد المتطايرة في الوقود الصلب؟
- 2- ماهي المزايا التي تتميز بها محارق الوقود الصلب مقارنة بالمواقد؟

(12 درجة)

س5:- وضع مايلي مع الرسم:

- 1- تعتبر القدرة العليا من خصائص بنزين الطائرات. وضح كيف تؤثر القدرة مع نسبة الهواء/ الوقود.
- 2- يوجد الغاز الذائب والمركبات الخفيفة بكميات متفاوتة مع البترول الخام يجعله غير ثابت، كيف تتم عملية التخلص من الغاز الذائب والمركبات الخفيفة وتثبيت البترول.

(12 درجة)

GOOD LUCK



Note: Answer 4 questions only.

Q1:- If $f(x, y, z) = 0$, find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}$, then show that $(\frac{\partial x}{\partial y})_z (\frac{\partial y}{\partial z})_x (\frac{\partial z}{\partial x})_y = -1$

(25 mark)

Q2:- Find six different iterated triple integrals for the integration

$I = \iiint_D z \, dv$, where D is the region bounded by $z = 0$, $z = x$, and $y^2 = 4 - 2x$. Evaluate one of the integrals.

(25 mark)

Q3:-A) Prove that $y = c_1 \cos 3x + c_2 \sin 3x$, is a solution of the differential equation $y'' + 9y = 0$, and then find c_1 & c_2 , if $y(0) = 1, y(\frac{\pi}{2}) = -1$.

(15 mark)

B) Evaluate $\beta(\frac{7}{2}, \frac{-5}{2})$?

(10 mark)

Q4:- A) If $z = x + iy$, and $w = u + iv$, where $w = z^3 + iz^2$. Express u & v in terms of x & y , and show that if the function $w = f(z)$ satisfies the Cauchy – Riemann conditions or not?

(10 mark)

B) If $A = i - j + 2k$, $B = 2i + j + k$, and $C = i + 2j - k$, three vectors. Prove that $(A \times B) \times C = (A \cdot C)B - (B \cdot C)A$.

(15 mark)

Q5:-A) Find Fourier Series for $f(x) = x^2$, for $-\pi < x < \pi$.

(10 mark)

B) Find eigen value & eigen vector for $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 1 \\ 0 & 2 & 4 \end{bmatrix}$.

(15 mark)

GOOD LUCK



ملاحظة:- الاجابة عن خمسة اسئلة فقط.

س1/ الجدول التالي يمثل الضغوط البخارية للبروبانول بدرجات حرارية مختلفة :

T/°c	40	60	80	100
p/kpa	6.69	19.6	50.1	112.3

احسب حرارة التبخر المولارية للبروبانول علماً بأن $R=8.3J\ mol^{-1}\ k^{-1}$.

(٢٠ درجة)

س2/ أ- اعطي نصاً لقاعدة الطور مع الاشتقاق.

ب- بدرجة 25 °م يسلك تفاعل سلوك معين بواسطة التفاعل المباشر وسلوك اخر باستخدام العامل المساعد وجد ان طاقة التنشيط للتفاعل المباشر تزيد في حالة استخدام العامل المساعد بحوالي 10 كيلو جول/مول، احسب النسبة بين ثابت سرعة التفاعل الاول الى الثاني.

(٢٠ درجة)

س3/ أ- عدد منحنيات الامتزاز عند ثبوت درجة الحرارة مع ذكر الرسم الخاص بكل منحنى.

ب- تفاعل ذو مرتبة احادية يمكن تمثيل مسلكه بالمعادلة التالية :

$$\text{Log } k\ (\text{min}^{-1}) = 33.9 - (36300/RT)$$

ماهو الزمن اللازم لـ (5 مول) من المادة المتفاعلة لكي يتم تفاعل (25%) من المادة المتفاعلة بدرجة (227°م).

(٢٠ درجة)

س4/ أ- اشتق ثابت سرعة التفاعل لتفاعل عكسي.

ب- اذا كانت قيمة التوصيل النوعي لمحلول يتكون من (0.1M) كلوريد البوتاسيوم و(0.2 M) NCl تساوي ($0.0382\ \Omega^{-1}\ \text{cm}^{-1}$) اوجد التوصيل المولاري للايون الموجب N^{+1} علماً ان قيمته لكل من K^{+1} ، Cl^{-1} هي 74 ، 76 $\Omega^{-1}\ \text{cm}^2\ \text{mol}^{-1}$ على التوالي.

(٢٠ درجة)

س5/ اذا اعطيت الخلية التالية :



أ- مثل بمعادلات تفاعل كل من القطبين والتفاعل التام للخلية.

ب- اوجد قيمة (E°) عند درجة حرارة 25 °م علماً ان قيمة (E) تساوي 0.93 فولت.

(٢٠ درجة)

س6/ أ- عند تجزؤ احد المركبات المذابة في الماء امكن الحصول على النتائج التالية:

2.48	1.1	0.5	التركيز الابتدائي (M)
174	880	4280	عمر النصف (sec)

اوجد رتبة التفاعل ثم جد ثابت سرعة التفاعل.

ب- ما المقصود بالاستقطاب مع ذكر انواعه.

(٢٠ درجة)

مع امنياتي بالنجاح



Note: Answer 3 questions only.

س 1 / ما نوع السلطه عند كل من توماس هوبز ونيقولا ميكافيلي
ب/ ما الفرق بين الاتجاه الاشتراكي والاتجاه الرأسمالي لحقوق الانسان

س 2 / علل مما ياتي

(1) لماذا يعتبر البعض الاسلام علماني

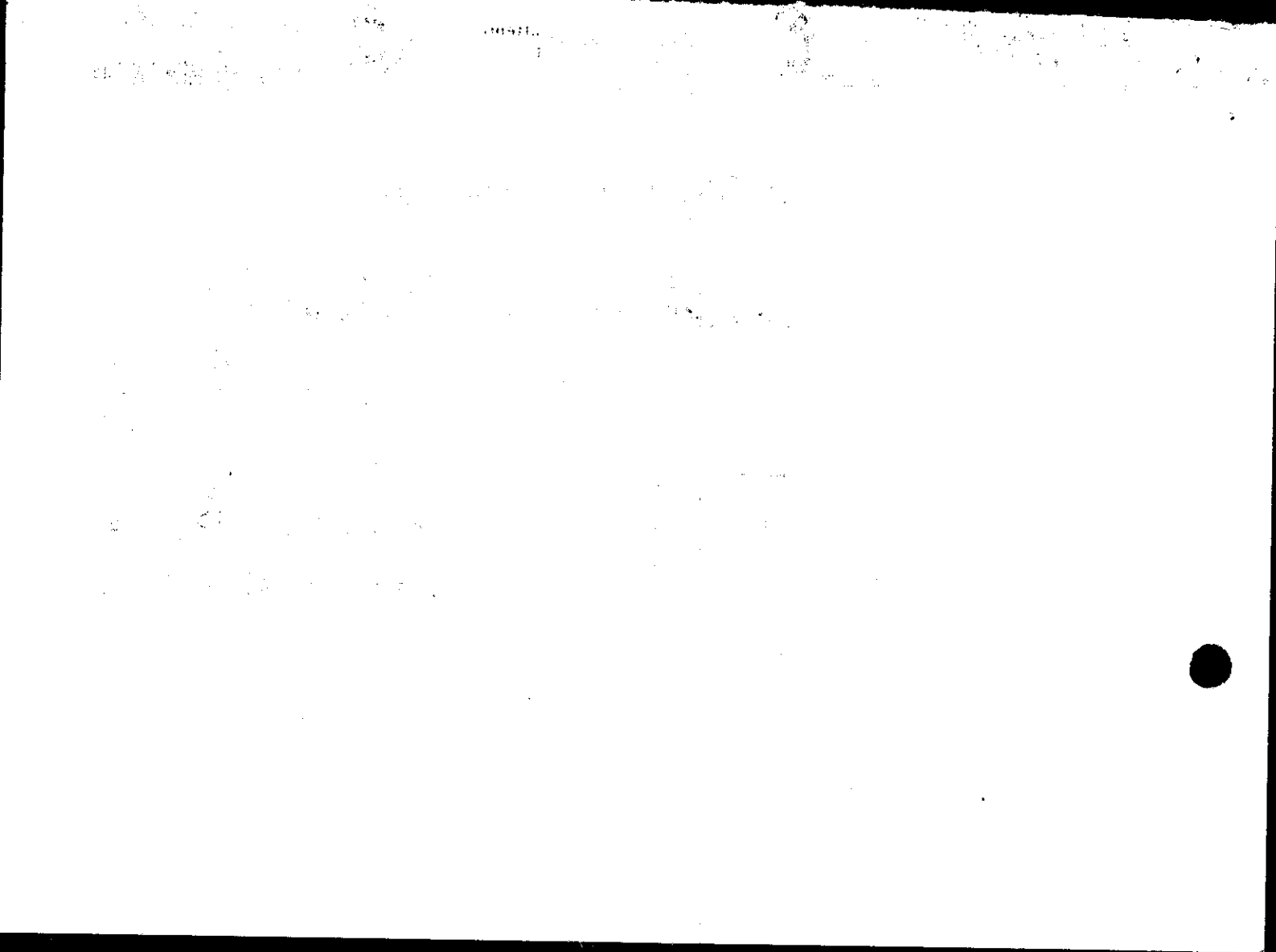
(2) لماذا يعبر تيار الوعظ التوفيقي عن نوع من الكسل الفكري

ب/ كيف يمكن التأكد على اهمية تاصيل قيم حقوق الانسان في الثقافة العربية

س 3 ماهي اهم التيارات الاسلاميه المعاصره وما هو موقفها من حقوق الانسان

س 4 اوضح علاقة البناء النفسي بالحرريات

GOOD LUCK





ANSWER ONLY FIVE QUESTIONS

Q1- A cylindrical rod 100mm long and having a diameter of 10mm is to be deformed using a tensile load of 27500N. It must not experience either plastic deformation or diameter reduction of more than 7.5×10^{-3} mm. Which of the materials in the following table may be used ? Why?

material	Modulus of Elasticity (GPa)	Yield strength (MPa)	Poisson's Ratio
Aluminium alloy	70	200	0.33
Brass alloy	101	300	0.35
Steel alloy	207	400	0.27

(20Marks)

Q2- Consider the Cu-Ni system, then:-

a- What is the solubility limit of copper in solid α at 1300°C?

b- What is the solubility limit of nickel in the liquid at 1300°C?

c- How many grams of nickel must be added to 500grams of copper to produce an alloy that contains 50w/o α at 1260°C?

d- A 65w/o Cu-35w/o Ni alloy is slowly cooled from 1300°C to 1150°C, At what temperature does the liquid solidify? What is the composition of this last remaining liquid phase?

(20Marks)

Q3- A BCC iron structure is to be manufactured that will allow no more than 50gram of hydrogen to be lost per year through each square centimeter of the iron at 400°C. If the concentration of hydrogen at one surface is 0.05 H atom per unit cell and is 0.001 H atom per unit cell at the second surface, determine the minimum thickness of the iron.

Hint: $-Q_d = 3600$ cal/mole, $D_0 = 0.0012 \text{ cm}^2/\text{sec}$, radius of iron atom = 0.1241 nm.

(20Marks)

Q4- (A)- Sketch the following planes and directions:- Within a cubic unit cell:-

(111), [111], (020)

(B)- Answer the following:

1- Classify the materials.

2- Write the eutectic reaction for iron-carbon system.

(20Marks)

Q5- Ten grams of nickel are to be electroplated on a steel surface with an area of 0.8953 m^2 . The electrolyte contains Ni^{+2} ions.

a- How thick will the nickel plate be?

b- How many amperes are required if this is to be accomplished in 60 minutes?

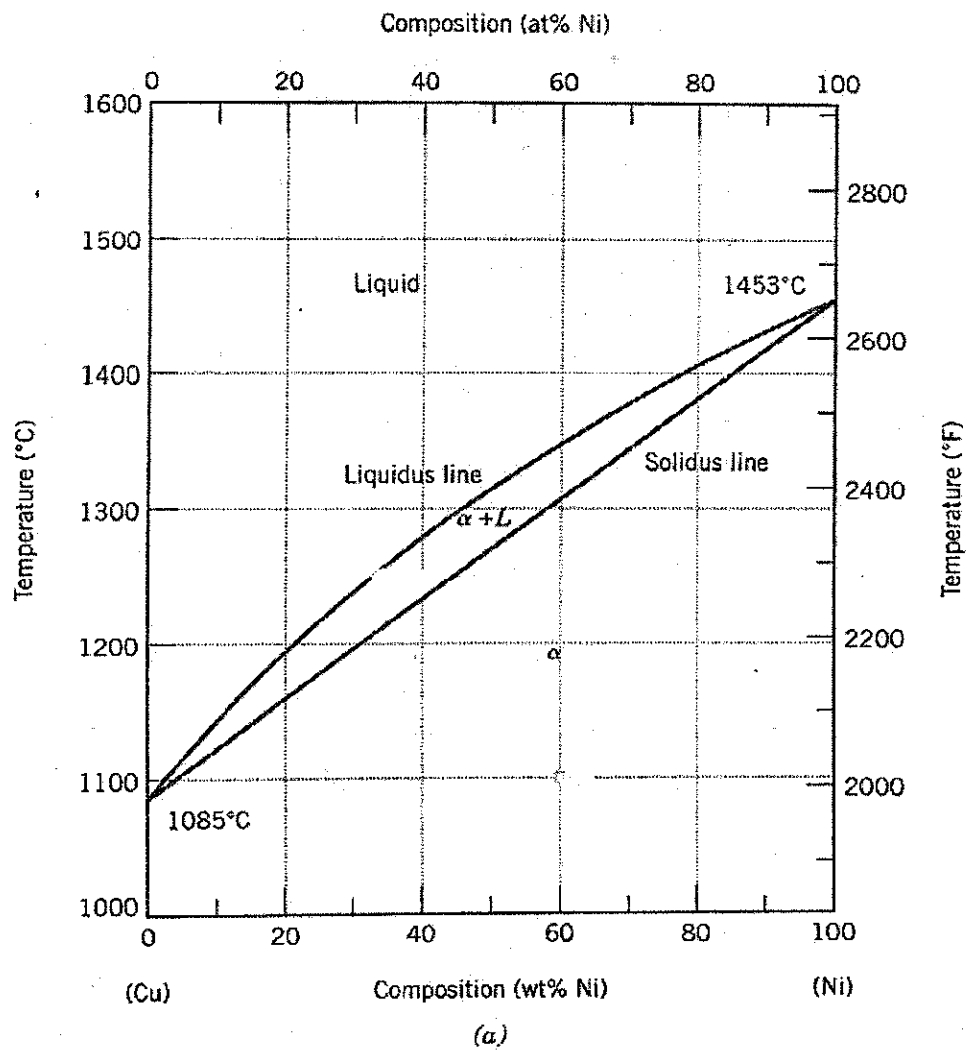
The density of Ni = 8.9 g/cm^3 , atomic weight of Ni = 58.71 g/mole.

(20Marks)

Q6- Answer (eight only) YES or NO, Correct the wrong:

1. For substitutional solid solution, the solute and solvent atoms must have similar atomic diameter.
2. The burgers vector of screw dislocation is parallel to the dislocation line.
3. each water molecule in steam has along-range atomic arrangement.
4. There are (14) types of Bravais lattices, grouped in seven crystal systems.
5. The maximum solubility of carbon in BCC iron is 0.03w/o C.
6. Microscopic defects are called bulk defect.
7. The tensile strength is the stress required to initiate plastic deformation.
8. The diffusion coefficient is greater when the packing factor is lower.
9. Interfacial imperfections are larger than line imperfections and occur over two dimensional area.

(20Marks)





Note: Answer four questions only

Visual Basic

Q1 A: Short Answer

1. What is the difference between a text box and input box (give an example)?
2. What is the difference between a checkbox and OptionButton (give an example)?

[12.5]

Q1 B: Liquid methanol is to be burned with an excess air. The engineer must calculate the highest temperature that the furnace walls will have to withstand so that an appropriate material of construction can be chosen. The methanol is assumed to be fed at 25°C and the air enters at 100°C. The energy balance calculations show that the adiabatic flame temperature of the furnace is given by:

$$7.535 \times 10^{-12} T^4 - 1.393 \times 10^{-8} T^3 - 4.913 \times 10^{-5} T^2 - 0.4738 T + 681.7 = 0$$

Write a program (design and code) to solve the resulted equation for the adiabatic flame temperature.

[12.5]

Q2: Write a program (design and code) which can be used as database for Critical properties of chemical components in the table below.

Compound name	Formula	Tc(K)	Pc(MPa)	Zc
Methane	CH ₄	190.6	4.604	0.288
Ethane	C ₂ H ₆	305.4	4.88	0.284
Propane	C ₃ H ₈	369.8	4.249	0.281
Butane	C ₄ H ₁₀	425.2	3.797	0.274
Pentane	C ₅ H ₁₂	469.7	3.369	0.269

Note: Use inputbox to enter the chemical component name.

[25]

Matlab

Q3 A: if you have the following two matrixes

$$A = [2 \ 7 \ 9 \ 7; 3 \ 1 \ 5 \ 6; 8 \ 1 \ 2 \ 5]$$

$$B = [2 \ 1 \ 8 \ 4; 6 \ 2 \ 8 \ 8; 1 \ 3 \ 9 \ 3], \text{ explain the results of the following commands:}$$

1. C=A.*B
2. C=A(:,3)+B(:,1)
3. C=2*A-B
4. C=min(A)+max(B)
5. C=[A;B]

[12.5]

Q3 B: Write MATLAB code to solve the following system of linear algebraic equations:

$$2x_1 + 4x_2 - x_3 + x_4 = 6$$

$$-x_1 + 2x_2 + x_3 - x_4 + x_5 = 8$$

$$-x_2 - x_3 + 2x_4 + x_5 = -12$$

$$4x_1 + x_2 + x_3 + x_4 + 2x_5 = -2$$

$$6x_1 + 2x_3 - 4x_4 - 2x_5 = 4$$

[12.5]

Q4 A: The experimental velocity of an incompressible fluid in a pipe of radius 1 m is tabulated as below:

$r \text{ (m)}$	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$u \text{ (m/s)}$	1.0	0.99	0.96	0.91	0.84	0.75	0.64	0.51	0.36	0.19	0.0

Where r is the distance from the centre of the pipe and u is the velocity of the fluid. Write a computer program to:-

1. Fit the experimental velocity to the following function:

$$u = a + br + cr^2$$

2. Calculate volumetric flow rate according to equation given by:

$$Q = \int_0^1 2\pi r u dr \quad [12.5]$$

Q4 B: Use *one loop* with the aid of *interp1* command in MATLAB program to plot Txy diagram for benzene/toluene system. Knowing that the vapor pressures for these two components are calculated by:

$$P_{\text{Benzene}}^o = \exp(10.4 - \frac{3740}{T + 5.8})$$

$$P_{\text{Toluene}}^o = \exp(9.0 - \frac{3500}{T + 10})$$

Where:-

$$K_i = P_i^o / P_t$$

$$P_t = 1 \text{ atm}$$

$$y_i = K_i \times x_i$$

$$\text{At Bubble point } \sum y_i = \sum K_i \times x_i = 1$$

[12.5]

Q5 A: Write MATLAB code to:

1. Graph $y = x^2 + 2x + 5 - \frac{1}{x}$ for x in the range $[-4 \ 4]$ and y in the range $[-10, 10]$.

2. Graph three dimensional plot of the following system of equation:

$$y = t^2$$

$$x = \exp(\sin(t)) \quad \text{For } t \text{ in the range of } [-50, 50].$$

$$z = \cos(t)$$

Note: add x, y and z axis labels and title for each graph.

[12.5]

Q5 B: Rotameter calibration data (flow rate versus Rotameter reading) are as follows:

Flow rate V(L/min)	20	52.1	84.6	118.3	151
Rotameter Reading R	10	30	50	70	90

Write a code to:

a. Draw a calibration curve and add the required labels.

b. Calculate the flow rate that corresponds to a Rotameter reading of 36. [12.5]

GOOD LUCK



Note: Answer only four questions.

Q1/

A- A vertical gap 2.2 cm wide of infinite extent contains a fluid of viscosity 2 Pa.s and sp.gr. 0.9. A metallic plate (1.2 m X 1.2 m X 0.2 cm) and weigh 5 kg is to be lifted up with constant velocity of 0.15 m/s through the gap. If the plate is in middle of the gap, find the force required to lift it up. (5-marks)

B- A catalyst having spherical particles of $d_p = 50$ microns and $\rho_p = 1.65 \text{ g/cm}^3$ is to be used to contact a hydrocarbon vapor in a fluidized reactor at 482 °C, 1.0 atm. At rest, the bed has a porosity of 0.35 and height of 1.0 m. At operating conditions, the fluid viscosity is 0.02 c.p. and its density is 3.364 kg/m³. Determine u_{mf} , transportation velocity, and extent of the bed expansion at the onset fluidization (L_{mf}). What the type of fluidization occurs?

Take that for these pickings $e_{mf} = 1 - 0.83[(\log d_p) - 1]$, d_p in microns. (7.5-marks)

Q2/

A- The resistance (F) of falling spherical particle depends upon the following variables:

- Diameter of particle (D) - Speed of particle (u) - Fluid density (ρ)
- Fluid dynamic viscosity (μ) - Gravitational acceleration (g)

From a dimensional analysis, use an appropriate method; obtain a relation between the force (F) and these variables. (5-marks)

B- A rotameter tube of 0.3 m long with an internal diameter of 25 mm at the top and 20 mm at the bottom. The diameter of float is 20 mm, its sp.gr. is 4.8 and its volume is 6 cm³. If the coefficient of discharge is 0.7, what will be the flow rate water when the float is half way up the tube? (7.5-marks)

Q3/

A- The velocity distribution in laminar flow through a circular pipe for non-Newtonian power-law liquids in steady-state flow is:

$$u_x = u \left(\frac{3n+1}{n+1} \right) \left[1 - \left(\frac{2r}{d} \right)^{(n+1)/n} \right], \quad \text{show that } -\dot{\gamma}_w = -\frac{du_x}{dr} \bigg|_{r=\frac{d}{2}} = \left(\frac{8u}{d} \right) \left(\frac{3n+1}{4n} \right)$$

where u_x : is the velocity at r in x-direction, r : is the distance from the centreline, d : is the diameter of the pipe, u : is the mean linear velocity, n : is the flow behavior index, and $\dot{\gamma}_w$: is the shear rate at walls. (5-marks)

B- Water in a tank flows through an outlet 25 m below the water level into a 0.15 m I.D. $e = 0.0015\text{m}$ horizontal pipe 30 m long, with 90° elbow at the end leading to vertical pipe of the same diameter 15 m long. This is connected to a second 90° elbow, which leads to a horizontal pipe of the same diameter, 60 m long, containing a fully open globe valve and discharge to atmosphere 10 m below the level of the water in the tank. Calculate the initial flow rate. Take that, $Le/d = 40$ for elbow and $= 250$ for valve. and the fanning friction factor could be estimated from $(f)^{-0.5} = 4.06 \log(d/e) + 2.16$ (7.5-marks)

Q4/

A- From the velocity distribution of Newtonian fluid in laminar flow $u_x = u_{\max} [1 - (r/R)^2]$, show that the average velocity is half the centerline (maximum) velocity. (5-marks)

B- It is required to pump cooling water from storage pond to a condenser in a process plant situated 10 m above the level of the pond. 200 m of 74.2 mm i.d. pipe is available and the pump has the characteristics given below. The head loss in the condenser is equivalent to 16 velocity heads based on the flow in the 74.2 mm pipe. If the friction factor $\Phi = 0.003$, estimate the rate of flow and the power to be supplied to the pump assuming $\eta = 0.5$ (7.5-marks)

Q (m ³ /s)	0.0028	0.0039	0.005	0.0056	0.0059
Δh (m)	23.2	21.3	18.9	15.2	11.0

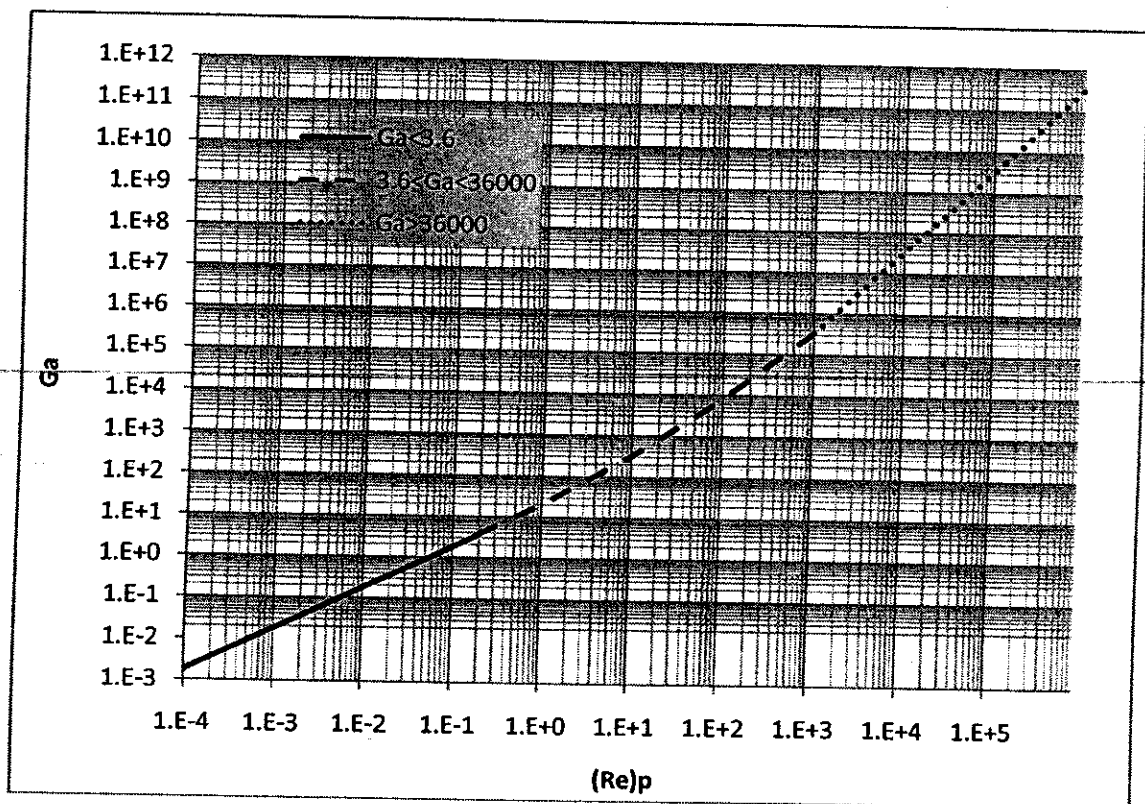
Follow

Q5/

A- Numerate the types of agitators that used in liquid mixing and give an example of each type. Then calculate the theoretical power in Watt for a 0.1 m diameter 6-blade flat blade turbine agitator running at 16 rev/s in a tank system without baffles and conforming to the standard tank configuration. The liquid in the tank has a dynamic viscosity of 0.08 kg/m.s and a liquid density of 900 kg/m³. Take that the power function ($\Phi = 2.2$). (5-marks)

B- Air enters at a pressure of 3.5 MPa and a temperature of 500°C to a converging-diverging nozzle. The air flow rate through the nozzle is 1.3 kg/s and it leaves the nozzle at a pressure of 0.7 MPa. The expansion of air may be considered adiabatic. Calculate the area of throat and the exit area. Take $\gamma = 1.4$. (7.5-marks)

$$\dot{m}^2 = A_2^2 \frac{2\gamma}{(\gamma-1)} \frac{P_1}{v_1} \left(\frac{P_2}{P_1} \right)^{2/\gamma} \left[1 - \left(\frac{P_2}{P_1} \right)^{(\gamma-1)/\gamma} \right]$$



GOOD LUCK



Note: Answer four questions only.

Q1: An ideal gas undergoes the following sequence of mechanically reversible process:

a/ From an initial state of 70°C and 1bar it is compressed adiabatically to 150 °C.

b/ It is then cooled from 150 °C to 70°C at constant pressure.

C/ Finally ,it is expanded isothermally to its original state.

Calculate W,Q,ΔU and ΔH for each three processes and for the total cycle.Take
 $C_v=(3/2)R$ and $C_p=(5/2)R$.

(15mark)

Q2: a/ One mole of an ideal gas with constant heat capacities undergoes an arbitrary mechanically reversible process, from the first law of thermodynamics show that :

$$\Delta U = [1 / (\gamma - 1)] \Delta (P.V). \quad (7.5 \text{ mark})$$

b/ Calculate "Z" and "V" for isopropanol vapor at 200°C and 10 bar using Virial equation with two terms, where Virial coefficient of isopropanol vapor is (-388 cm³/mole).

(7.5 mark)

Q3: a/ Air at (1bar) and (25C) enters a compressor at low velocity, discharges at (3bar), and enters a nozzle in which it expands to a final velocity of (600m/sec) at the initial conditions of pressure and temperature. If the work of compression is (240KJ / Kg) of air, how much heat must be removed during compression?

(5 mark)

b/ The binarysystem acetonitrile(1)/nitromethane(2) conforms closely to Rault,s law. Vapor pressure for the pure species are given by the following Antonine eqations:

$$\ln P_1^{\text{sat}} / \text{Kpa} = 14.2724 - [2945.47 / (T/^{\circ}\text{C} - 224.0)]$$

$$\ln P_2^{\text{sat}} / \text{Kpa} = 14.2043 - [2972.64 / (T/^{\circ}\text{C} - 209.0)]$$

Prepare a graph showing P vs. x_1 and P vs. y_1 for a temperature of (75°C).

(10 mark)

Q4: A conventional vapor –compression refrigeration system operates on the cycle with throttling valve. For the following operating conditions, determine the circulation rate of the refrigerant, the heat transfer rate in the condenser, the power requirement, the coefficient of performance of the cycle, and the coefficient of performance of a Carnot refrigeration cycle operating between the same temperature levels.

Refrigerant is water: evaporation $t = 44.56 (^{\circ}\text{F})$; condensation $t = 178.43 (^{\circ}\text{F})$;
 η (compressor) = 0.75 ; refrigeration rate = 1500 Btu /sec.

Note: 1Btu = 1055 J

H = SPECIFIC ENTHALPY (kJ kg)

S = SPECIFIC ENTROPY (kJ kg⁻¹ K⁻¹)

		TEMPERATURE: T kelvins (TEMPERATURE: t ^{°C})									
P/kPa T ^{sat} /K(t ^{sat} /°C)		sat. liq.	sat. vap.	573.15 (300)	623.15 (350)	673.15 (400)	723.15 (450)	773.15 (500)	823.15 (550)	873.15 (600)	923.15 (650)
1 280.13(6.98)	V	1.000	129200.	284500.	287580.	310050.	333780.	356810.	379880.	402960.	426040.
	U	26.334	2385.2	2812.3	2889.9	2989.1	3049.9	3132.4	3216.7	3302.8	3390.3
	H	29.335	2514.4	3076.8	3177.5	3279.7	3383.6	3489.2	3596.5	3705.6	3816.4
	S	0.1060	8.9767	10.3450	10.5133	10.6711	10.8200	10.9612	11.0957	11.2243	11.3476
10 318.98(45.83)	V	1.010	14670.	20440.	28750.	31080.	33370.	35670.	37980.	40290.	42600.
	U	191.822	2438.0	2812.2	2889.8	2989.0	3049.8	3132.3	3216.6	3302.8	3390.3
	H	191.832	2584.8	3076.6	3177.3	3279.4	3383.5	3489.1	3596.5	3705.5	3816.3
	S	0.6493	8.1511	9.2820	9.4504	9.6083	9.7572	9.8984	10.0329	10.1616	10.2849
20 339.24(60.09)	V	1.017	7649.6	13210.	14370.	15520.	16680.	17830.	18990.	20140.	21300.
	U	251.432	2456.9	2812.0	2889.6	2989.9	3049.7	3132.3	3216.5	3302.5	3390.2
	H	251.453	2606.9	3076.4	3177.1	3279.4	3383.4	3489.0	3596.4	3705.4	3816.2
	S	0.8321	7.9094	8.9618	9.1303	9.2882	9.4372	9.5784	9.7130	9.8416	9.9650
30 342.27(68.12)	V	1.022	5229.3	8810.6	9591.2	10350.	11120.	11890.	12660.	13430.	14190.
	U	288.271	2466.6	2811.6	2889.5	2989.7	3049.6	3132.2	3216.6	3302.5	3390.2
	H	288.302	2625.4	3076.1	3176.8	3279.3	3383.3	3488.9	3596.3	3705.4	3816.2
	S	0.9441	7.7695	8.7744	8.9430	9.1010	9.2499	9.3912	9.5257	9.6544	9.7778
40 349.04(75.89)	V	1.027	3983.4	6806.5	7184.6	7762.5	8340.1	8917.4	9494.9	10070.	10640.
	U	317.609	2477.1	2811.6	2889.4	2989.6	3049.5	3132.1	3216.4	3302.4	3390.1
	H	317.650	2636.9	3075.9	3176.8	3279.1	3383.1	3488.8	3596.2	3705.3	3816.1
	S	1.0261	7.6709	8.6413	8.8100	8.9690	9.1170	9.2583	9.3929	9.5216	9.6450
50 354.50(81.35)	V	1.030	3240.2	5283.9	5746.7	6209.1	6671.4	7133.5	7595.5	8057.4	8519.2
	U	340.513	2484.0	2811.5	2889.2	2989.5	3049.4	3132.0	3216.3	3302.3	3390.1
	H	340.564	2645.0	3075.7	3176.6	3279.0	3383.0	3488.7	3596.1	3705.2	3816.0
	S	1.0912	7.5947	8.5380	8.7068	8.8648	9.0139	9.1552	9.2898	9.4185	9.5419
75 364.94(91.79)	V	1.037	2216.9	3520.5	3829.4	4138.0	4446.4	4754.7	5062.8	5370.9	5678.9
	U	384.374	2496.7	2811.0	2888.9	2989.2	3049.2	3131.8	3216.1	3302.2	3389.9
	H	384.451	2663.0	3075.1	3176.1	3278.6	3382.7	3488.4	3595.8	3705.0	3815.9
	S	1.2131	7.4570	8.3502	8.5191	8.6773	8.8266	8.9678	9.1025	9.2312	9.3546
100 372.79(99.63)	V	1.043	1693.7	2638.7	2870.8	3102.5	3334.0	3565.3	3796.5	4027.7	4258.8
	U	417.406	2506.1	2810.6	2888.6	2988.0	3049.0	3131.6	3216.0	3302.0	3389.8
	H	417.511	2675.4	3074.5	3175.6	3278.2	3382.4	3488.1	3595.6	3704.8	3815.7
	S	1.3027	7.3598	8.2166	8.3858	8.5442	8.6934	8.8346	8.9685	9.0962	9.2217

(15mark)

Q5: The gas stream from a sulfur burner consists of 15 mol% SO₂, 20 mol% O₂, and 65 mol% N₂. The gas stream at atmospheric pressure and 500 °C enters a converter where 86 mol% of the SO₂ is further oxidized to SO₃. On the basis of 1mol of gas entering, how much heat must be removed from the converter so that product gases leave at 500 °C?

Substance	$\Delta H^{\circ}_{f298}(\text{J})$	Cp(J/mol.K)
SO2	-296830	39.87
O2	0	29.389
SO3	-395720	50.665

(15mark)

R=8.314 J / mol. K = 83.14 bar. cm³/mol. K

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الإجابة على أربعة أسئلة فقط من ضمنها السؤال الأول

س ١ :- وقود يتكون من 36 mole % بنتان و 64 mole % هيكسان تم حرقه مع 10% هواء زائد . احسب النسبة المئوية للغاز العادم الناتج من الاحتراق إذا كان 80% من الوقود تم حرقه ليكون ثاني اوكسيد الكربون.

المعطيات :- الوزن الذري: C=12, H=1, N=14, O=16, S=32

(١٤ درجة)

س ٢ :- (١) اختر الجواب الصحيح :

- ١- تتم السيطرة على نوعية وقود الطائرات التوربيني بتعين نسبة _____ التي يجب أن لا تتعدى ٢٠% ويمقياس نقطة الدخان. (المركبات: البرافينية، الاولييفينية، العطرية)
- ٢- يمثل الحد الأدنى من نسبة الرافع عند _____ من الصواني. (العدد اللانهائي، الحد الأدنى)
- ٣- تبلغ حصيللة غاز الفحم عند الكربنة بدرجة الحرارة العالية حوالي (٢٠٠ م^٣/طن، ١٠٠ م^٣/طن، ٣٢٠ م^٣/طن)

(ب) وضح ما يلي :-

- ١- ما هي مساوئ وجود غازي كبريتيد الهيدروجين وثاني اوكسيد الكربون في الغاز الطبيعي؟
- ٢- كيف تتم صناعة الغاز الطبيعي التخليقي ذو المحتوى العالي من الميثان؟ وضح ذلك بالمعادلات الكيميائية أيضا.

(١٢ درجة)

س ٣ :- (١) عرف ما يأتي:

- ١- القيمة الحرارية؟ وكيف يتم تعيينها؟ وما هي وحداتها لأنواع الوقود المختلفة.
- ٢- غاز الفرن العالي؟ ما هو تركيبه.
- ٣- المرجل البخاري؟ وما هي الأجهزة والمعدات المساندة والإضافية التي يحتاجها المرجل البخاري.

(ب) وضح ما يلي :-

- ١- كيف تتم تنقية النفط من المركبات الكبريتية؟
- ٢- ما هي العوامل التي تؤثر على اختيار نوعية الوقود؟

(١٢ درجة)

س ٤ :- أكمل ما يأتي :-

- ١- إن من أهم المصادر المختلفة للطاقة _____ و _____ و _____ و _____ و _____
- ٢- عرف المتبقي الذي يسحب من برج التقطير الفراغي _____
- ٣- أن من أهم أنواع غازات التصفية والتي تظهر بصورة عرضية في عمليات تصنيع البترول المختلفة _____ و _____ و _____
- ٤- أن من أهم خصائص احتراق الخشب _____ و _____ و _____
- ٥- المواد الصلبة الشائعة في تجفيف الغاز الطبيعي في عملية الامتزاز _____ و _____ و _____
- ٦- يجب أن لا تتعدى النسبة المئوية للرماد في وقود زيت الوقود _____

(١٢ درجة)

س ٥ :- وضح ما يلي بالرسم فقط :

- ١- القطفات الناتجة من عملية التقطير الفراغي للبترول الخام.
- ٢- الحصول على البنزين الثابت من الغاز الطبيعي.

(١٢ درجة)

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ملاحظة: الإجابة عن خمسة أسئلة فقط. (كل سؤال 20 درجة)

س1/ الجدول التالي يوضح الضغوط البخارية لثلاثي كلوروميثان بدرجات حرارية مختلفة.

Temp./°C	20	30	40	50
P/mmHg	160	248	369	535

1- أحسب حرارة التبخر المولارية لثلاثي كلوروميثان علماً أن $R = 8.30 \text{ J K}^{-1} \text{ mol}^{-1}$.

س2/ الجدول التالي يمثل النتائج التي تم الحصول عليها من امتزاز احد الغازات على الفحم الحيواني.

p/mmHg	100	200	500	900
Gas adsorbed/mg g ⁻¹	1.56	1.97	2.29	2.41

أحسب ثوابت لانكميور للامتزاز.

س3/

أ- ناقش استعمالات قاعدة الطور لنظام الماء.

ب- لتفاعل من المرتبة الاولى تبلغ قيمة طاقة التنشيط (125000) سرعة/مول وقيمة معامل التردد 5×10^{13} ثانية، بأي درجة حرارة يبلغ عمر النصف لهذا التفاعل دقيقة واحدة؟ ثم أحسب الزمن اللازم لتفاعل 90% من التفاعل.

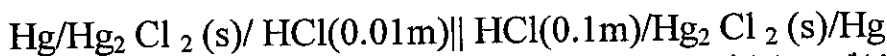
س4/

أ- التوصيل النوعي لمحلول مائي مشبع من كلوريد الفضة عند درجة حرارة 25°C هي (3.4×10^{-6}) اوم⁻¹ سم⁻¹ بينما تبلغ قيمتها للماء المستعمل (1.6×10^{-6}) اوم⁻¹ سم⁻¹ فاذا علمت ان التوصيل المولاري لكل من ايوني Ag^+ و Cl^- في نفس درجة الحرارة تبلغ 61.92 اوم⁻¹ سم² مول⁻¹ و 76.34 اوم⁻¹ سم² مول⁻¹ على التوالي احسب قابلية ذوبان كلوريد الفضة في الماء.

ب- أكتب ميكانيكية التفاعلات الانزيمية.

س5/

أ- أشتق ثابت سرعة التفاعل لتفاعل عكسي؟
ب- اذا اعطيت خلية التركيز



اكتب تفاعلات القطب والتغيرات الناشئة عن انتقال ايونات الهيدروجين ومحصلة تفاعل الخلية. ثم أحسب جهد الخلية.

س6/

أ- ما المقصود بالتوصيل المكافئ والتوصيل الجزيئي ونسبة التوصيل.

ب- في تحليل خلايا الاثيل باستخدام تراكيز متساوية من خلايا الاثيل وهيدروكسيد الصوديوم تم الحصول على النتائج التالية:

t(min)	0	5	15	25	35
V _{HCl} ml	16.0	10.24	6.13	4.32	3.41

أوجد رتبة التفاعل ثم احسب ثابت سرعة التفاعل.



Note: Answer 3 questions only.

س1 تكلم عن الموقف الاسلامي العربي المعاصر من حقوق الانسان؟

س2 أ/ ما علاقة الحرية الاقتصادية بالحرية السياسية ؟

ب/ ما معنى التحضر وما علاقته بحقوق الانسان؟

س3 أ/ ما هي اهداف حقوق الانسان وماذا تولد خروقاته؟

ب/ تكلم عن الحرية السياسية في المجتمع العربي بايجاز؟

س4 أ / هل تتعارض الحرية الفردية مع حرية المجتمع ؟

ب/ وضح معنى العولمة وما علاقتها بحقوق الانسان؟

مدرس المادة
د. بشرى عبدالله

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Note: Answer 4 questions only.

Q1:- Find a) $(\frac{\partial w}{\partial y})_x$, b) $(\frac{\partial w}{\partial y})_z$ at the point $(w, x, y, z) = (4, 2, 1, -1)$
if $w = x^2 y^2 + yz - z^3$, and $x^2 + y^2 + z^2 = 6$.
(25 mark)

Q2:- Solve the 2nd order differential equation: –
 $y'' - y' - 6y = e^{-x} - 7 \cos x$.

(25 mark)

Q3:-A) Integrate the function $f(x, y) = \frac{x}{y}$ over the region in the first quadrant bounded by the lines $y = x$, $y = 2x$, $x = 1$ and $x = 2$.
(15 mark)

B) Evaluate $I = \int_0^{\infty} \sqrt[3]{z} e^{-z^4} dz$.
(10 mark)

Q4:- A) If $z = re^{i\theta}$, evaluate $\oint z^{-4} dz$, around a circle with its center at the origin.

(10 mark)

B) Find the distance d between the point $P(2, -3, 4)$ and the plane $x + 2y + 2z = 13$.

(15 mark)

Q5:-A) Find Fourier Series for $f(x) = x$, for $-1 < x < 1$.

(10 mark)

B) Find A^{-1} using row reduction method for $A = \begin{bmatrix} 2 & 3 & -4 \\ 1 & 2 & 3 \\ 3 & -1 & -1 \end{bmatrix}$.

(15 mark)

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