Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	TECHNICAL SCIENCE II
COURSE CODE	:	DAS 12703
PROGRAMME	:	DAK
EXAMINATION DATE	:	JUNE / JULY 2018
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **PART A, ONE (1)** QUESTION IN **PART B** AND **ONE (1)** QUESTION IN **PART C**

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THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

PART A

Q1 (a) (i) Distiguish between *electrolytic cells* and *voltaic cells.*

(2 marks)

(ii) Differentiate between oxidizing agent and reducing agent in terms of electron gain or loss.

(4 marks)

(iii) Write the relationship between the numbers of electrons gained and lost in a redox reaction.

(2 marks)

(b) Consider the given cell diagram:

$$Ag \mid Ag^{+} \parallel Cd^{2+} \mid Cd$$

(i) Identify the half-reaction that would represent the reduction and oxidation in this cell. Label the electrode.

(4 marks)

(ii) Write the net reaction in the direction consistent with the way the cell is written.

(2 marks)

(c) Consider the following galvanic cell:

$$Zn(s) + 2H^{+}(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$$

(i) Write half – reaction for anode and cathode.

(4 marks)

(ii) Determine the $E°_{cell}$ for this reaction.

(2 marks)

(iii) Calculate the cell potential, E when $[Zn^{2+}] = 1.0$ M and $[H^{+}] = 6.3 \times 10^{-6}$ M.

(5 marks)

Q2 (a) Define series and parallel circuit.

(2 marks)

(b) Based on circuit shown in **Figure Q2(b)**, calculate:

(i) Node voltage equation 1, V_1

(2 marks)

(ii) Node voltage equation 2, V_2

(2 marks)

(iii) The values of V_1 and V_2 based on the equation (i) and (ii)

(6 marks)

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(c) Three resistors with 5 Ω, 8 Ω and 13 Ω respectively, are connected in series to a battery of 30 V.

(i) Draw the circuit diagram.

(3 marks)

(ii) Calculate the total resistance.

(2 marks)

(iii) Compute the total amount of current in the circuit.

(2 marks)

(iv) Determine the potential difference across every resistor in the circuit.

(6 marks)

PART B

Q3 (a) Most combustion reactions occur in excess O_2. Calculate the mass of CO_2, in grams that can be produced by burning 6.00 mol of CH_4 in excess O_2.

(9 marks)

(b) Find the maximum mass of $Ni(OH)_2$ that could be prepared by mixing two solutions that contain 25.9 g of $NiCl_2$ and 10.0 g of NaOH, respectively.

(9 marks)

(c) A 15.6 g sample of C_6H_6 is mixed with excess HNO_3. 18.0 g of $C_6H_5NO_2$ is formed.

(i) Write the balanced chemical equation for this reaction.

(2 marks)

(ii) Compute the percent yield of $C_6H_5NO_2$ in this reaction.

(5 marks)

Q4 (a) Write the factors affecting rate of reaction.

(4 marks)

(b) Butadiene reacts to form its dimer according to the given equation:

$$2\ C_4H_6(g) \longrightarrow C_8H_{12}(g)$$

Data on **Table Q4(b)** were collected for this reaction at a given temperature:

(i) Identify the order of reaction by plotting a graph of $\ln[C_4H_6]$ versus t and $1/[C_4H_6]$ versus t.

(15 marks)

(ii) Compute the value of the rate constant for this reaction.

(4 marks)

(iii) Determine the half – life for the reaction under the conditions of this experiment.

(2 marks)

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PART C

Q5 (a) A ball is thrown from the top of a building is given an initial velocity of 17.0 ms^{-1} straight upward. The building is 45 m high and the ball just misses the edge of the roof on its way down as shown in **Figure Q5(a)**. Calculate:

(i) maximum height of the stone from point A.

(2 marks)

(ii) time taken from point A to C.

(2 marks)

(iii) time taken from point A to D.

(3 marks)

(iv) velocity of the stone when it reaches point D.

(3 marks)

(b) **Figure Q5(b)** shows a ball thrown by superman with an initial speed, u = 300 ms^{-1} and makes an angle, θ = 70.0° to the horizontal. Determine.

(i) the magnitude and direction of its velocity, when t = 2.0s.

(8 marks)

(ii) time taken for the ball reaches the maximum height, H and calculate the value of H.

(4 marks)

(iii) horizontal range, R

(3 marks)

Q6 (a) Stress, strain and forces are practically being applied in our daily life. Based on the situations below, solve the following problems:

(i) A steel rod 2 m long has a cross sectional area of 0.3 cm^2. The rod is hung by one end from a support structure and a 550 kg weight is hung from the rod's lower end, causing it to elongate 1.8 mm. Calculate the stress and strain of the rod.

(4 marks)

(ii) A circular steel wire with length 2m must stretch no more than 0.25 cm when the tensile force of 400 N is applied to one end of the wire. Determine the minimum diameter that is required for the wire. ($Y_{steel} = 20 \times 10^{10}$ Pa)

(4 marks)

(b) Given three concurrent forces acting on a bracket. Based on **Figure Q6(b)**, find the magnitude and direction of the resultant force.

(8 marks)

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(c) A brass pipe 7 m long is placed vertically under a sagging floor to support it. The inside diameter of the pipe is 300 mm while the outside diameter is 340 mm. Given that Young's modulus for brass, $Y_{brass} = 3 \times 10^{11}$ Pa. A sensitive strain gauge indicates that the pipe's length decreases by 0.4 mm. Calculate the magnitude of the load supported by the pipe.

(9 marks)

- END OF QUESTION -

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FIGURE

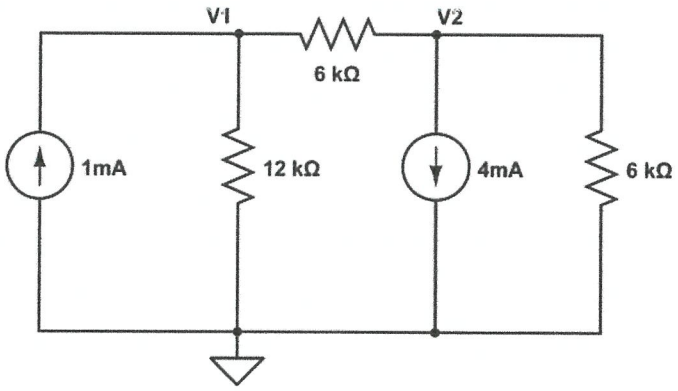

Figure Q2(b)

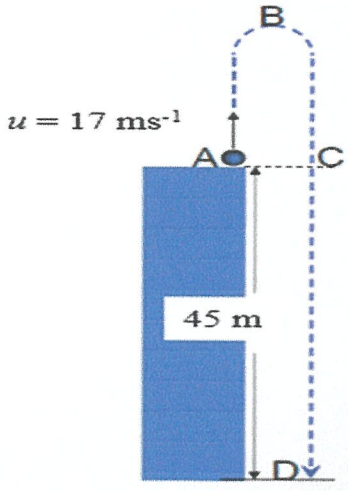

Figure Q5(a)

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FIGURE

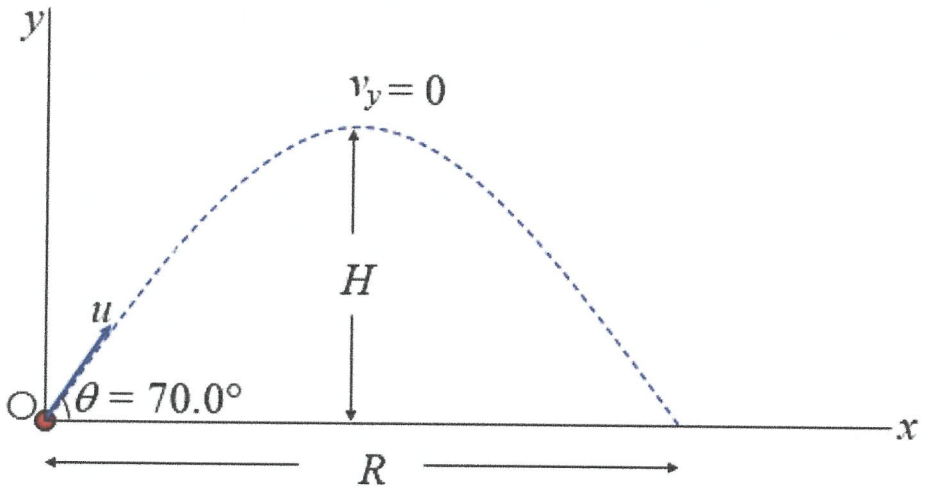

Figure Q5(b)

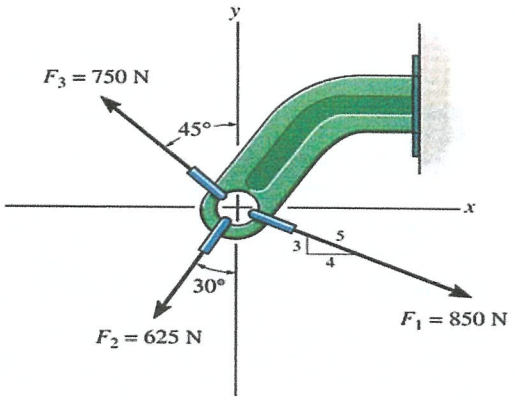

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Figure Q6(b)

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TABLE

Table Q4(b)

$[C_4H_6]$ (mol/L)	Time (seconds)
0.0100	0
0.00625	1000
0.00476	1800
0.00370	2800
0.00313	3600
0.00270	4400
0.00241	5200
0.00208	6200

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FORMULAE

List of Formula

$$v_{ave} = \frac{x_f - x_i}{t}$$

$$a_{ave} = \frac{v_f - v_i}{t}$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(u + v)t$$

Velocity	x - component	y – component
initial velocity	$u_x = u\cos\theta$	$u_y = u\sin\theta$
Velocity	$v_x = u_x - g\,t\,;\, g = 0$ $v_x = u_x$	$v_y = u_y - g\,t$
	$v_x^2 = u_x^2 - 2g\,s_x\,;\, g = 0$ $v_x = u_x$	$v_y^2 = u_y^2 - 2gs_y$
Displacement	$s_x = u_x\,t - \frac{1}{2}g\,t^2\,;\, g = 0$ $s_x = u_x\,t$	$s_y = u_y\,t - \frac{1}{2}gt^2$

$$V^2 = V_x^2 + V_y^2$$

$$V = IR$$

$$A = \pi r^2$$

$$F = mg$$

$$F = kx$$

$$\sigma = \frac{F}{A}$$

$$\varepsilon = \frac{\Delta L}{L}$$

$$S = \frac{F}{A} \cdot \frac{L}{\Delta x}$$

$$Y = \frac{F}{A} \cdot \frac{L}{\Delta L}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$v = u + at$	$v_y = u_y - gt$
$v^2 = u^2 + 2as$	$v^2_y = u^2_y - 2gs_y$
$s = ut + \frac{1}{2}at^2$	$s_y = u_y t - \frac{1}{2}gt^2$
$s = vt - \frac{1}{2}at^2$	$s_y = v_y t + \frac{1}{2}gt^2$
$s = \frac{1}{2}(u + v)t$	$s = \frac{1}{2}(u_y + v_y)t$

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List of Constant Value

Gravitational acceleration, $g = 9.81\ m \cdot s^{-2}$

1 feet = 12 inch

1 mile = 1609 meter

1 inch = 2.54 cm

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Atomic No.	*Atomic Weight*	*Name*	*Sym.*	*Atomic No.*	*Atomic Weight*	*Name*	
1	1.01	Hydrogen	H	31	69.72	Gallium	Ga
2	4.00	Helium	He	32	72.64	Germanium	Ge
3	6.94	Lithium	Li	33	74.92	Arsenic	As
4	9.01	Beryllium	Be	34	78.96	Selenium	Se
5	10.81	Boron	B	35	79.90	Bromine	Br
6	12.01	Carbon	C	36	83.80	Krypton	Kr
7	14.01	Nitrogen	N	37	85.47	Rubidium	Rb
8	16.00	Oxygen	O	38	87.62	Strontium	Sr
9	19.00	Fluorine	F	39	88.91	Yttrium	Y
10	20.18	Neon	Ne	40	91.22	Zirconium	Zr
11	22.99	Sodium	Na	41	92.91	Niobium	Nb
12	24.31	Magnesium	Mg	42	95.94	Molybdenum	Mo
13	26.98	Aluminum	Al	43	98.00	Technetium	Tc
14	28.09	Silicon	Si	44	101.07	Ruthenium	Ru
15	30.97	Phosphorus	P	45	102.91	Rhodium	Rh
16	32.07	Sulfur	S	46	106.42	Palladium	Pd
17	35.45	Chlorine	Cl	47	107.87	Silver	Ag
18	39.95	Argon	Ar	48	112.41	Cadmium	Cd
19	39.10	Potassium	K	49	114.82	Indium	In
20	40.08	Calcium	Ca	50	118.71	Tin	Sn
21	44.96	Scandium	Sc	51	121.76	Antimony	Sb
22	47.87	Titanium	Ti	52	127.60	Tellurium	Te
23	50.94	Vanadium	V	53	126.90	Iodine	I
24	52.00	Chromium	Cr	54	131.29	Xenon	Xe
25	54.94	Manganese	Mn	55	132.91	Cesium	Cs
26	55.85	Iron	Fe	56	137.33	Barium	Ba
27	58.93	Cobalt	Co	57	138.91	Lanthanum	La
28	58.69	Nickel	Ni	58	140.12	Cerium	Ce
29	63.55	Copper	Cu	59	140.91	Praseodymium	Pr
30	65.39	Zinc	Zn	60	144.24	Neodymium	Nd

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Atomic No.	*Atomic Weight*	*Name*	*Sym.*	*Atomic No.*	*Atomic Weight*	*Name*	*Sym.*
61	145.00	Promethium	Pm	91	231.04	Protactinium	Pa
62	150.36	Samarium	Sm	92	238.03	Uranium	U
63	151.96	Europium	Eu	93	237.00	Neptunium	Np
64	157.25	Gadolinium	Gd	94	244.00	Plutonium	Pu
65	158.93	Terbium	Tb	95	243.00	Americium	Am
66	162.50	Dysprosium	Dy	96	247.00	Curium	Cm
67	164.93	Holmium	Ho	97	247.00	Berkelium	Bk
68	167.26	Erbium	Er	98	251.00	Californium	Cf
69	168.93	Thulium	Tm	99	252.00	Einsteinium	Es
70	173.04	Ytterbium	Yb	100	257.00	Fermium	Fm
71	174.97	Lutetium	Lu	101	258.00	Mendelevium	Md
72	178.49	Hafnium	Hf	102	259.00	Nobelium	No
73	180.95	Tantalum	Ta	103	262.00	Lawrencium	Lr
74	183.84	Tungsten	W	104	261.00	Rutherfordium	Rf
75	186.21	Rhenium	Re	105	262.00	Dubnium	Db
76	190.23	Osmium	Os	106	266.00	Seaborgium	Sg
77	192.22	Iridium	Ir	107	264.00	Bohrium	Bh
78	195.08	Platinum	Pt	108	277.00	Hassium	Hs
79	196.97	Gold	Au	109	268.00	Meitnerium	Mt
80	200.59	Mercury	Hg				
81	204.38	Thallium	Tl				
82	207.20	Lead	Pb				
83	208.98	Bismuth	Bi				
84	209.00	Polonium	Po				
85	210.00	Astatine	At				
86	222.00	Radon	Rn				
87	223.00	Francium	Fr				
88	226.00	Radium	Ra				
89	227.00	Actinium	Ac				
90	232.04	Thorium	Th				

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BASIRAH BINTI FAUZI
Pensyarah
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