Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	TECHNICAL SCIENCE II
COURSE CODE	:	DAS 12703
PROGRAMME	:	1 DAB / 1 DAJ / 1 DAR / 1 DAK
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	SECTION A) ANSWER **ALL** QUESTIONS
		SECTION B) ANSWER **ONE (1)** QUESTION
		SECTION C) ANSWER **ONE (1)** QUESTION

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

SECTION B

Q3 (a) Define the following terms.

(i) Chemical equation

(2 marks)

(ii) Limiting reactant

(2 marks)

(iii) Actual yield

(1 mark)

(b) 50 g of sodium hydroxide (NaOH) reacted with 49 g of sulphuric acid (H_2SO_4) forming sodium sulphate (Na_2SO_4) and water molecule (H_2O).

(i) Write a balanced chemical equation of the reaction.

(2 marks)

(ii) Determine the limiting reactant.

(5 marks)

(iii) Calculate the Na_2SO_4 formed from the reaction (in gram).

(3 marks)

(c) (i) Name any two units of solution concentration that normally used in chemistry analysis.

(2 marks)

(ii) Water is added to 125.00 mL of 0.350 M KNO_3 solution until the volume of the solution is exactly 500 mL. Calculate the concentration of the final solution.

(3 marks)

(d) The SO_2 present in air is mainly responsible for the acid rain phenomenon. Its concentration can be determined by titrating against a standard permanganate solution as follows:

$$5SO_2 + 2KMnO_4 + 2H_2O \rightarrow 2MnSO_4 + K_2SO_4 + 2H_2SO_4$$

Calculate the number of grams of SO_2 in a sample of air, if 15.50 mL of 0.025 M $KMnO_4$ solution is required for the titration.

(5 marks)

Q4 (a) Briefly summarize the effects of each of the four factors that affect rates of reactions.
(8 marks)

(b) Rate data were collected for the following reaction at a particular temperature.

$$2ClO_2\,(aq) + 2OH^-\,(aq) \longrightarrow ClO_3\,(aq) + H_2O\,(l)$$

Experiment	$[ClO_2]$ (mol/L)	$[OH^{-1}]$ (mol/L)	Initial Rate (M/s)
1	0.012	0.012	2.07×10^{-4}
2	0.012	0.024	4.14×10^{-4}
3	0.024	0.012	8.28×10^{-4}
4	0.024	0.024	1.66×10^{-3}

(i) Identify the rate – law expression for this reaction.
(10 marks)

(ii) Describe the order of the reaction with respect to each reactant and to the overall order.
(3 marks)

(iii) Calculate the value, with unit for the specific rate constant, k.
(4 marks)

SECTION C

Q5 (a) A projectile is launched from a cliff 100 m above level ground with a launce velocity of 20 ms^{-1} and angle of 20° above the horizontal. The projectile reach the ground at time 2 s.

(i) Calculate the projectile maximum horizontal range.

(3 marks)

(ii) Determine the maximum vertical displacement it can reach from the ground.

(4 marks)

(b) **Figure Q5(b)** shows a box with a mass m_1 = 15 kg go down a distance s on an inclined plane with a slope of angle $\alpha = 30°$ when the box is coupled by a rope and a pulley to a bucket with mass m_2 = 20 kg. Ignore the friction force, the moment of inertia of the pulley and the mass of the rope.

(i) State the Newton's Second Law in words and mathematical form.

(2 marks)

(ii) Draw a free-body diagram for the force acting on object 1 and 2.

(3 marks)

(iii) Calculate the acceleration on the system.

(10 marks)

(iv) Calculate the tension on the string.

(3 marks)

Q6 (a) List **THREE (3)** types of deformation

(3 marks)

(b) **FIGURE Q6(c)** shows the upper surface of a Styrofoam of thickness 150.0mm, length 7.0cm and width 2.0cm is displaced 0.64 cm by a tangential force. Given that the shear modulus, S, of the Styrofoam is 940 Pa. Calculate:

(i) The magnitude of the tangential force

(6 marks)

(ii) The shear stress on the Styrofoam

(3 marks)

(c) (i) Define Young Modulus

(1 marks)

(ii) A copper cylinder is stacked end to end with a brass cylinder as shown in **FIGURE Q6 (c) (ii)**. The length of the copper and brass cylinder as 3.0cm and 5.0cm respectively. Each cylinder has a radius 0.35cm. A compressive force F = 6550 N is applied to the right end of the brass cylinder. Determine the new length of each cylinder.
(Given : Y_{copper} = 110 GPa, Y_{brass} = 90GPa)

(12 marks)

- END OF QUESTION -

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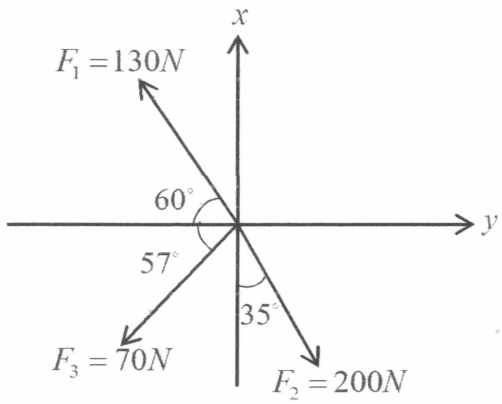

FIGURE Q1 (a)

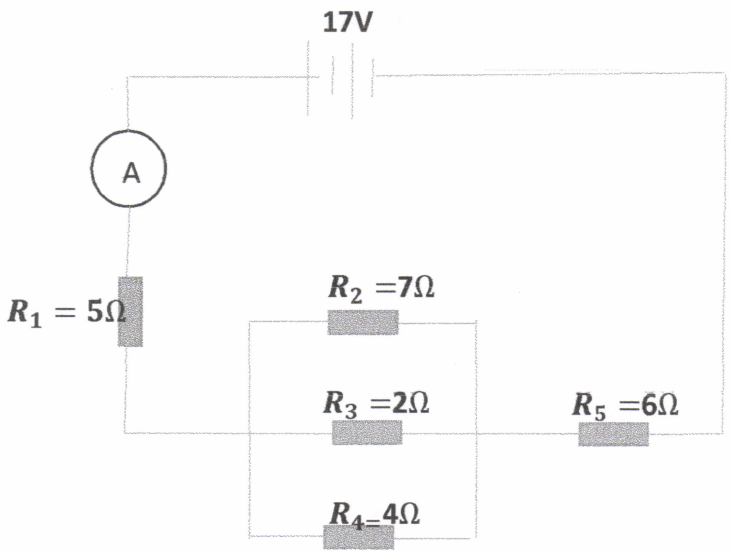

FIGURE Q1 (c)

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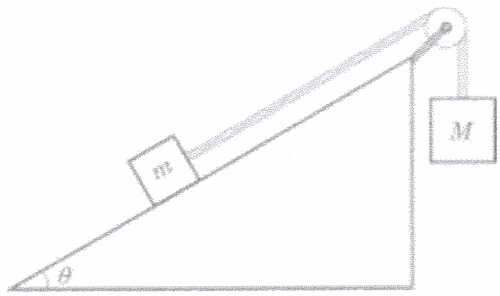

FIGURE Q5 (b)

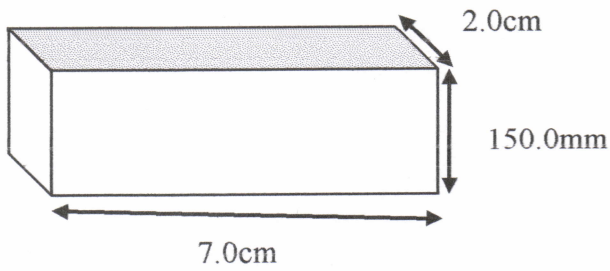

FIGURE Q6 (c)

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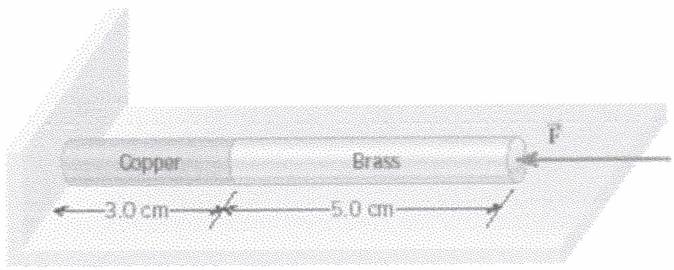

FIGURE Q6 (c) (ii)

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Atomic No.	*Atomic Weight*	*Name*	*Sym.*	*Atomic No.*	*Atomic Weight*	*Name*	*Sym.*
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				