UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	TECHNICAL SCIENCE I
COURSE CODE	:	DAS 12603
PROGRAMME	:	1 DAK
EXAMINATION DATE	:	DECEMBER 2016 / JANUARY 2017
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	A) ANSWER **ALL** QUESTIONS IN **PART A** B) ANSWER **ONE (1)** QUESTION ONLY IN **PART B** C) ANSWER **ONE (1)** QUESTION ONLY IN **PART C**

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

PART A

Q1 (a) A covalent bond is a chemical bond in which two or more electrons are shared by two or more atoms. Classify the formation of single, double and triple bond with suitable examples.

(6 marks)

(b) A hydrogen bond is the attractive force between the hydrogen attached to an electronegative atom of one molecule and an electronegative atom of a different molecule.

(i) Illustrate a graphic with explanation that indicates the bonding.

(3 marks)

(ii) Explain the formation of $MgCl_2$ compound by using Lewis dot symbols.

(3 marks)

(c) (i) Draw Lewis structure that obey the octet rule for H_2CO. Assign the formal charge for each atom.

(5 marks)

(ii) Write Lewis structure for N_2O_4. Show resonance structure, where applicable. N_2O_4 exists as $O_2N - NO_2$

(8 marks)

Q2 (a) Define the followings:

(i) Pressure

(2 marks)

(ii) Density

(2 marks)

(iii) Explain the important to calculate the density of matter?

(2 marks)

(b) **Figure Q2 (b)** shows the water reservoir. If the surface area of water is 50 km^2 with average depth 40.0 m Determine the followings:
(Density of water = 1.000 x10^3 kg/m^3)

(i) Volume of the water

(3 marks)

(ii) Mass of the water

(3 marks)

(iii) If a diver had dive into depth of 30m, calculate the pressure that he feel.

(6 marks)

(c) **Figure Q2 (c)** shows an iceberg floating on seawater. If the density of ice is given by 920 kg/m^3 while the density of seawater is 1030 kg/m^3. Find the fraction of total volume of an ice exposed.

(7 marks)

PART B

Q3 (a) Give the systematic name for each compounds.

(i) $CsClO_4$

(1 mark)

(ii) $KBrO_3$

(1 mark)

(b) Maleic acid is an organic compound composed of 41.39% carbon, 3.47% hydrogen and the rest oxygen. If 0.129 mole of maleic acid has a mass of 15.0 g, find the empirical and molecular formula of maleic acid.

(10 marks)

(c) Americium is an element that does not occur naturally. It can be made in very small amounts in a device called a particle accelerator. Compute the mass in grams of a sample of americium containing six atoms.

(7 marks)

(d) The element of silver (Ag) has two naturally occurring isotopes: ^{109}Ag and ^{107}Ag with a mass of 106.905 amu. Silver consists of 51.82% ^{107}Ag and has an average atomic mass of 107.868 amu. Calculate the mass of ^{109}Ag.

(6 marks)

Q4 (a) Periodic table is a most significant tool that chemists use for organizing and recalling chemical facts. It arises from the periodic patterns in the electronic configurations of the elements.

(i) State the modern form of periodic law.

(1 mark)

(ii) Classify the periodic properties of Group 1A, 2A, 7A and 8A.

(4 marks)

(b) Given $_{14}Si$, $_{4}Be$, $_{7}N$, $_{17}Cl$ and $_{12}Mg$. Answer the following questions.

(i) Write the electron configuration for Be and N.

(1 mark)

(ii) From (i), identify the valence electron, group and period of the elements.

(2 mark)

(iii) Arrange Si, Cl and Mg according to the increasing of atomic radius. Justify your answer.

(3 mark)

(c) Ionization energy is the minimum energy required to remove an electron from a gaseous atom in its ground state.

(i) Express the first and second ionization energy reaction equation.

(2 mark)

(ii) Explain the ionization energy trend down the group and across the period in relation with atomic radius.

(3 mark)

(d) (i) Define electron affinity.

(1 mark)

(ii) By using shell diagram as an example, interpret why metals have a less likely chance to gain electrons.

(4 mark)

(iii) Generally, the elements in group 17 are easier to accept electron and exhibit negative E_a values. Explain the phenomenon.

(3 mark)

PART C

Q5 (a) A sphere with radius, r is 400 mm is floating in oil with density, $\rho = 0.78$ g/cm^3. *Gravity,* $g = 9.81\ m/s^2$ *and* $V_{sphere} = \frac{4}{3}\pi r^3$.

(i) Convert the density of oil in SI unit.

(3 marks)

(ii) Determine the buoyancy force of the sphere in SI unit.

(5 marks)

(b) In unit-vector notation, if $\vec{a} = 5.0\,i + 4.0\,j - 6.0\,k$, $\vec{b} = -2.0i + 2.0j + 3.0k$ and $\vec{c} = 4.0\,i + 3.0j + 2.0\,k$?

(i) Define $\vec{r} = \vec{a} - \vec{b} + \vec{c}$.

(5 marks)

(ii) Calculate the angle between $\vec{r}$ and the positive x axis

(4 marks)

(c) A fire fighter measures the height of a building by walking out a distance of 26.0 m from its base and shining a flashlight beam toward the top. When the beam is elevated at an angle of 39.0° with respect to the horizontal, as shown in **Figure Q5 (c)**, the beam just strikes the top of the building. If the flashlight is held at height of 0.90 m,

(i) Find the height of the building.

(4 marks)

(ii) Calculate the length of the light beam to reach top of building.

(4 marks)

Q6 (a) Give definitions for the followings

(i) Heat.

(2 marks)

(ii) Specific heat

(2 marks)

(b) Explain the following terms

(i) Latent heat of fusion

(2 marks)

(ii) Latent heat of vaporization

(2 marks)

(iii) Draw the temperature versus heat graph for phase change diagram of water

(4 marks)

(c) (i) Name **three (3)** types of heat transfer

(3 marks)

(ii) Express your answer in (i)

(6 marks)

(d) A block of steel is heated to 200 °C and then dropped into a beaker containing 0.4 kg of water that is initially at 20 °C. If the final equilibrium temperature of the mixed system is 22.4 °C, find the specific heat of the steel.
(Specific heat of water $= 4186 \frac{J}{kg} °C$*)*

(4 marks)

~ END OF QUESTION ~

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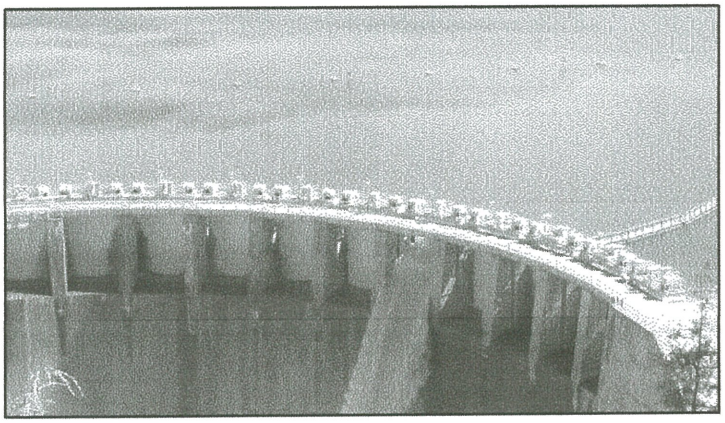

Figure Q2 (b)

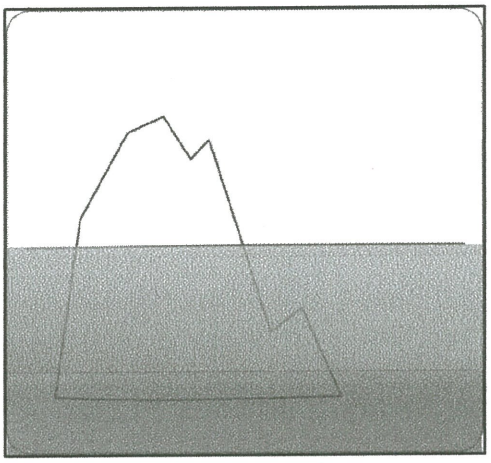

Figure Q2 (c)

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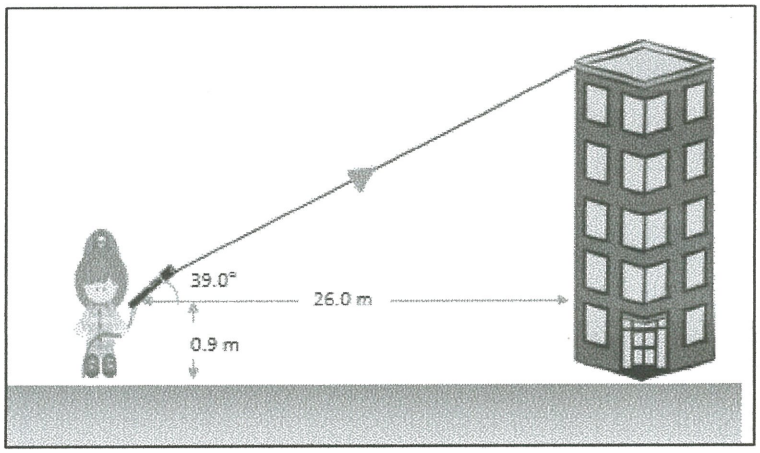

Figure Q5 (c)

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LIST OF FORMULA

$$F_b = \rho g V$$

$$\rho = \frac{m}{V}$$

$$T_K = T_C + 273.15$$

$$T_C = \frac{T_F - 32}{1.8}$$

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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				