UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	TECHNICAL SCIENCE 1
COURSE CODE	:	DAS 12603
PROGRAMME	:	1 DAB/DAR/DAF
EXAMINATION DATE	:	OCTOBER 2012
DURATION	:	2½ HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN PART **A, ONE (1)** QUESTION IN PART **B** AND **ONE (1)** QUESTION IN PART **C**

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

PART A

Q1 (a) Given two componds NaCl and HCl.

(i) Use Lewis dot symbols to show bonding between the elements that make up the compound.

(ii) Name the type of bond formed in each compound.

(iii) Which compound is capable of forming hydrogen bonding? Show the formation of hydrogen bonding in the chosen compound.
(Atomic number, Z : H = 1, Na = 11, Cl = 17)

(10 marks)

(b) Given the skeletal structure for nitrous oxide, N_2O is

N N O

(i) Complete the Lewis structure. Show resonance structure if any.

(ii) Calculate the formal charges for all atoms in the resonance structure.
(Atomic number, Z: N = 7, O = 8)

(15 marks)

Q2 (a) A submarine has a surface area of 300 m^2. The density of sea water is 1050 kgm^{-3}.

(i) At what depth under the sea will the additional pressure on the submarine be 5×10^5 Pa?

(ii) If the submarine is the depth determined in (i), calculate the force exerted by the sea water on the surface of the submarine.

(iii) If the atmospheric pressure is 10^5 Nm^{-2}, calculate the total pressure acting on the body of a diver at a depth of 450 m underwater.

(13 marks)

(b) **Figure Q2 (b)** shows a hydraulic jack whereby an elephant of 4.0×10^4 N is placed on the top of the larger piston.

(i) What is the minimum force needed to the smaller piston in order to lift the elephant?

(ii) What is the transmitted pressure?

(iii) If a hydraulic brake with a piston area of 4 cm^2, a force of 80 N is applied. What is the pressure transmitted throughout the liquid?

(12 marks)

PART B

Q3 (a) Phosphoric acid (H_3PO_4) is a colorless, syrupy liquid used in detergents, fertilizers, toothpastes and in carbonated beverages for a 'tangy' flavor.

(i) Calculate the molar mass of phosphoric acid.

(ii) Determine the percent composition by mass of hydrogen, phosphorus and oxygen in this compound.
(Relative Atomic Mass, H = 1, P = 31, O = 16)

(8 marks)

(b) A compound used as an additive for gasoline to help prevent engine knock shows the following composition:

71.65 % Cl 24.27 % C 4.07 % H

Determine the empirical and molecular formula for this compound, given that molar mass is 98.96 g.
(Relative Atomic Mass, Cl = 35.5, C = 12, H = 1)

(11 marks)

(c) How many moles and number of molecules are present in 2.56 mL of water. Given density of water is 1.00 g/mL at 4 °C.
(Relative Atomic Mass, H = 1, O =16, $N_A = 6.022 \times 10^{23}$, $\rho_{H_2O} = 1.00 g/mL$)

(6 marks)

Q4 (a) Which of the following is larger in radius?

(i) P and P^{3-}

(ii) Ca and Ca^{2+}
(Atomic number, Z : P = 15, Ca = 20)

(13 marks)

(b) (i) Define first ionization energy, IE_1.

(ii) Write an equation to represent the ionization of lithium, Li.

(iii) Describe briefly the trend in ionization energy across the period and down the group.

(12 marks)

PART C

Q5 (a) Determine if the dimension in each of the following equations are consistent. Given that x is distance, v is velocity, a is acceleration, g is gravity acceleration, t is time, m is mass, h is height, ρ is density and F is force.
Use $F = ma$.

(i) $$x = vt + \frac{at^2}{2}$$

(ii) $$amx + \frac{mv^2}{2} = Fx^2$$

(iii) $$\frac{F}{A} = h\rho g$$

(12 marks)

(b) Three coplanar forces act on a body at point O as shown in **Figure Q5 (b)**.
(i) Resolve each vector into their x–component and y–component vectors.
(ii) Find the magnitude and the direction of their resultant force.

(13 marks)

Q6 (a) Determine the amount of ice at – 10.0 °C needed to cool down 3 cm^3 of water at 100 °C to 20.0 °C.

(12 marks)

(b) How much heat is required to convert 3.7 cm^3 of aluminium at 20 °C to liquid at 700 °C? The melting point of aluminium is 660 °C.

(8 marks)

(c) Calculate the rate of heat flow through a glass window 200 cm x 150 cm in area and 0.33 cm thick, if the thermal conductivity of glass is 0.83 J/s. m. °C, and the inner and outer surface is 21°C and 38°C, respectively.

(5 marks)

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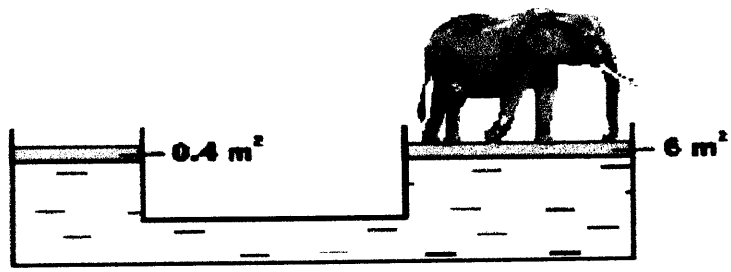

FIGURE Q2(d)

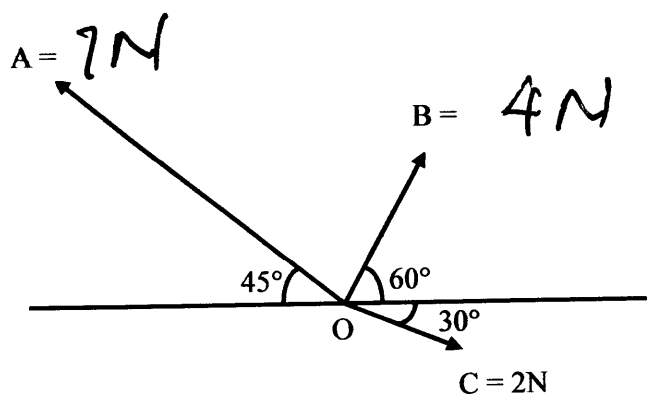

FIGURE Q5 (c)

(b)

FORMULAS

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$\rho = \frac{F}{A}$	$\frac{\Delta Q}{\Delta t} = kA\frac{T_{hot} - T_{cold}}{d}$
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$	$\rho = \frac{m}{V}$
$Q = mc\Delta T$	$Q = mL_f$ $Q = mL_v$

CONSTANTS

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1.	Gravity Acceleration, g	= 9.81 m/s^2
2.	Thermal Conductivity of glass, k	= 0.84J/s.m.^oC
3.	Specific Heat (water), c_{water}	= 4190J/kgK
4.	Specific Heat (ice), c_{ice}	= 2090J/kgK
5.	Latent Heat of Fusion, L_f	= 3.33×10^5J/kg
6.	Latent Heat of Vaporisation, L_v	= 22.6×10^5J/kg
7.	Density of water, ρ_{water}	= 1000kg/m^3
8.	Density of aluminium, $\rho_{aluminium}$	= 2702kg/m^3