# UTHM
### Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2013/2014

COURSE NAME : TECHNICAL SCIENCE I

COURSE CODE : DAS 12603

PROGRAMME : 1 DAB / 1 DAJ / 1 DAR / 1 DAK

EXAMINATION DATE : DECEMBER 2013/JANUARY 2014

DURATION : 3 HOURS

INSTRUCTION :

      A) ANSWER **ALL** QUESTIONS IN **SECTION A**

      B) ANSWER **ONE (1)** QUESTION ONLY IN **SECTION B**

      C) ANSWER **ONE (1)** QUESTION ONLY IN **SECTION C**

THIS QUESTION PAPER CONSIST OF **SEVEN (7)** PAGES

**SECTION A**

**Q1** (a) Define the following term:

(i) valence electrons
(ii) octet rule
(iii) ionic bond
(iv) covalent bond

(4 marks)

(b) Identify the bond type of the following substances by using the Lewis dot symbol. (Atomic number, $Z$ : C = 6 , H = 1, N = 7, Ca = 20,  O = 8)

(i) nitrogen gas, $N_2$
(ii) methane, $CH_4$
(iii) calcium oxide, CaO

(13 marks)

(c) Chloroform, $CHCl_3$ is a chemical substance that has been widely used as an anaesthetic. Chloroform is very poisonous and can cause breathing problems and problems with the heart. Draw the Lewis structure for chloroform and determine the formal charge for each atom in the substance.
(Atomic number, $Z$ : C = 6 , H = 1, Cl = 17)

(8 marks)

**Q2** (a) Define

(i) Pressure
(ii) Archimedes's Principle
(iii) Atmospheric pressure

(6 marks)

(b) A cubical box 20.0 cm on a side is completely immersed in a fluid. At the top of the box the pressure 105 kPa and the bottom the pressure is 106.8 kPa as shown in **FIGURE Q2(b).** Given Patm = $1.013 \times 10^5$ Pa. Find the

(i) density of the fluid
(ii) depth of fluid, $d$ at the top of the box
(iii) If a swimmer swimming below the surface ocean and let out a small bubble of air from mouth, as the bubble riser toward the surface does it diameter increase, decrease or stay the same?

(9 marks)

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(c)   When a block of volume $1.00 \times 10^{-3}$ m$^3$ is hung from a spring scale as shown in **FIGURE Q2(c)(i),** the scale reads 10.0 N. When the same block is then placed in an unknown liquid, it floats with 2/3 of its volume submerged as suggested in **FIGURE Q2(c)(ii),** The density of water is $1.00 \times 10^3$ kgm$^{-3}$. Determine the

(i)    mass of the block
(ii)   density of the unknown liquid

(10 marks)

**SECTION B.**

**Q3** (a) Isopentyl acetate ($C_7H_{14}O_2$), is the compound responsible for the scent of bananas and can be produced commercially. Interestingly, bees release about 1 µg ($1\times10^{-6}$ g) of this compound when they sting to attract other bees to join the attack.
(Relative atomic mass: H = 1, C = 12, O = 16, $N_A$ = 6.022×10²³)

      (i)     Write the molar mass of the compound.
      (ii)    Calculate the molecules of isopentyl acetate are released in a typical bee sting?

(8 marks)

(b) A sample of a compound contains 1.52 g of nitrogen (N) and 3.47 g of oxygen (O). The molar mass of this compound is between 90 g and 95 g. Determine the
(Relative atomic mass: N = 14, O = 16)

      (i)     Empirical and molecular formula of the compounds.
      (ii)    Accurate molar mass of the compound.

(16 marks)

(c) Balance the given equation for this reaction.

$$NH_3(g) + CuO(s) \rightarrow N_2(g) + Cu(s) + H_2O$$

(1 marks)

**Q4** (a)                                      Cs, F, K, Cl

      (i)     Draw the electron configuration of these elements.
      (ii)    Indicate the group and the period of these elements belong in periodic table.
      (iii)   Arrange the elements in order of increasing atomic radii. Justify your order.
(Atomic number; Cs= 55, F= 9, K= 19, Cl= 17)

(20 marks)

(b) Define:

      (i)     First ionization energy.
      (ii)    Electron affinity.
      (iii)   Electronegativity

(5 marks)

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**SECTION C**

**Q5** (a) Determine the volume of a sphere with it radius, r = 300mm. Express your answer in scientific notation and convert it into

(i) centimeter ($cm^3$)
(ii) meter ($m^3$)

Given: [Volume of a sphere, $v = (4/3) \times pi \times radius^3$], [pi ($\pi$)=3.1415926535]

(5 marks)

(b) The five coplanar shown in **FIGURE Q5(b)** act on an object. Find the resultant force and the angle of the force resultant.

(20 marks)

**Q6** (a) Define

(i) Temperature
(ii) Heat
(iii) Zeroth Law of Thermodynamics

(6 marks)

(b) To make steam, 5.60 x 105 J of heat to 0.220 kg of water at an initial temperature of 50 °C as shown in **FIGURE Q6(b).** Find the

(i) final temperature of the steam
(ii) From (i), find the answer in Degree Fahrenheit, °F

(9 marks)

(c) A large punch bowl holds 3.95 kg of lemonade which is essentially just water at 20 °C. A 0.0450 kg ice cube at 0 °C is placed in the lemonade. Find the

(i) final temperature of the system
(ii) If the cube mass of ice were 0.0750 kg, what would the final temperature of the system be.

(10 marks)

**- END OF QUESTION -**

**FIGURE Q2 (b)**



**FIGURE Q2(c)(i) in water and (ii) in unknown liquid.**

# FINAL EXAMINATION

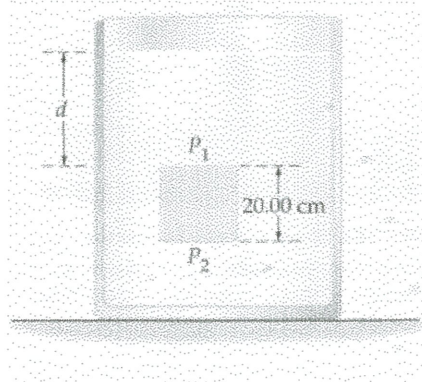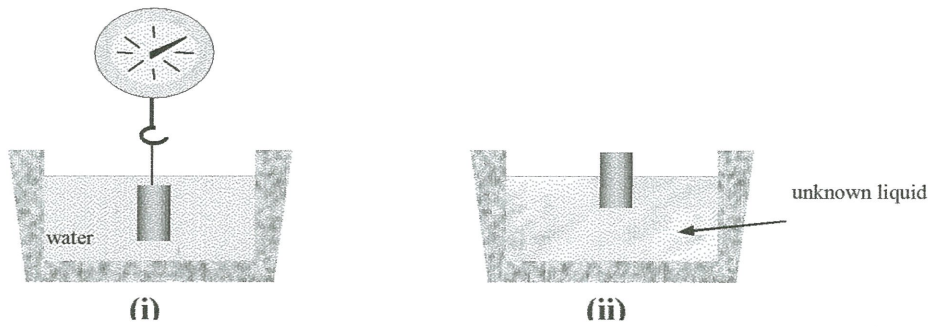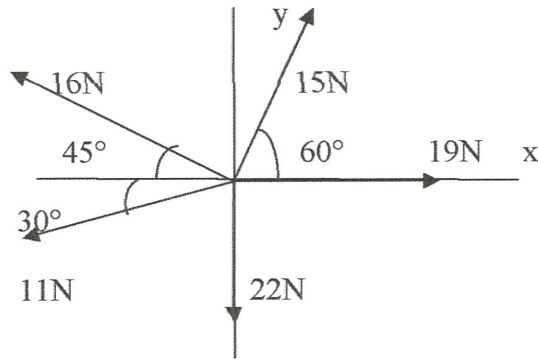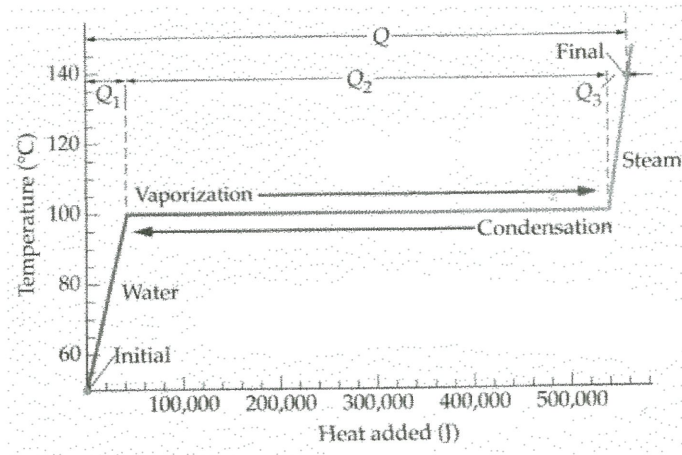| | | | |
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**FIGURE Q5 (b)**



**FIGURE Q6 (b)**