化學科 第一題參考答案

(1) $3Cu(s) + 8HNO_3\ (dilute) \rightarrow 3Cu^{2+} + 6NO_3^- + 2NO + 4H_2O$

$Cu(s) + 4HNO_3\ (conc.) \rightarrow Cu^{2+} + 2\ NO_3^- + 2NO_2 + 2H_2O$

(2) 70% HNO_3（70/63×1.41/100×1000 ～15.67 M）→ 1 M HNO_3（M1V1 ＝M2V2）：
Add 63-64（1000/15.67 ～63.8） mL of 70% nitric acid to about 700 mL of distilled water in a 1 liter measuring cylinder and make up to 1 L.

(3) HNO_3 is the limiting agent (0.02 mol, but Cu is 3/63.5 = 0.047 mol). 0.02/4 = 0.005 mol NO will be generated, corresponding to 0.005 × 24.5 = 0.1225 L （or 0.005 × 24.45 = 0.1223 L）Ans: 0.122 or 0.123 L

(4) 排水集氣法(water displacement for collecting gas)。NO is not very soluble or reactive with water. The other two methods are relatively to result in a leakage of the toxic NO.

(5) $2NO(g) + O_2\ (g) \rightarrow 2NO_2\ (g)$

$3NO_2\ (g) + H_2O\ (l) \rightarrow 2HNO_3\ (aq) + NO$

So the net reaction in the presence of water and oxygen would be

$4NO\ (g) + 3O_2\ (g) + 2H_2O\ (l) \rightarrow 4HNO_3\ (aq)$

(6) As NO_2 is red-brown and HNO_3 is colorless. He will see the generation of reddish-brown color and then a decay of the color back to colorless after a while.

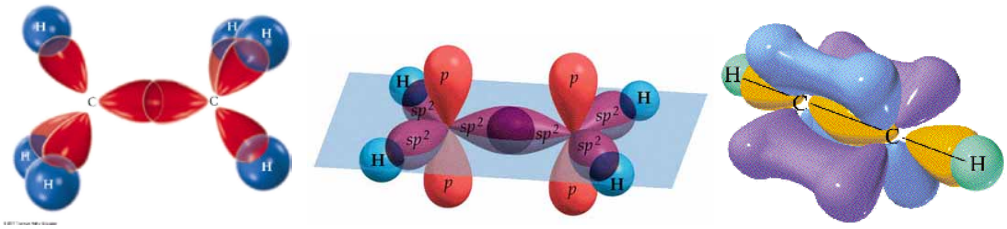
(7) He could add more oxygen to see if the reddish brown color generated again. If yes, then it means NO is present. He should add more O_2 to quench all the NO until no more color changed. Convert all the NO_2 to HNO_3 and neutralized with 1 M NaOH. The NO_2 gas can be directly discarded by slowly bubbling it through 1 M NaOH solution.

(8) NO_2 could dimerize to form colorless N_2O_4 in equilibrium. $2NO_2 \rightarrow N_2O_4$. At low temperature, the equilibrium shifts to the right, so the color intensity of NO_2 is decreased. At larger volume, the equilibrium shifts to the left, so the color grows.

(9) Syringe for adding HNO_3 and O_2; reaction chamber for gas generation; bottle for collecting the generated NO; tubing and adapters for connection.

化學科 第二題參考答案

(1)



(2) The C-C bond length is in the order ethane > ethene > ethyne, because the orbital size for bonding is $sp^3 > sp^2 > sp$.

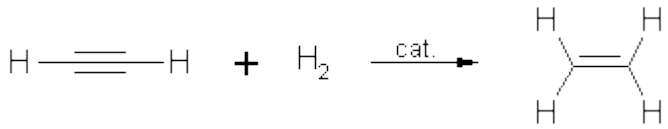
(3) $2\ C_2H_6 + 7\ O_{2\,(g)} \rightarrow 4\ CO_{2(g)} + 6\ H_2O$

$C_2H_4 + 3\ O_2 \rightarrow 2\ CO_2 + 2\ H_2O$

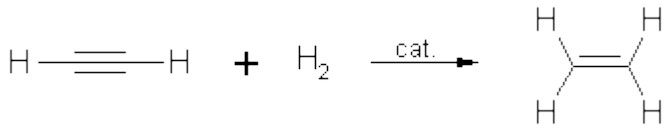
$2\ C_2H_2 + 5\ O_2 \rightarrow 4\ CO_2 + 2\ H_2O$

(4) Ethane, because more water is formed (more oxidation of hydrogen has occurred)

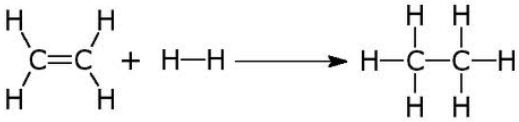
(5) Ethyne, because less molecules are formed (more energy per molecule)



(6) The bond energy (strength) of the two C-H sigma bonds formed in the product is larger than that of the C-C pi bond + the H-H sigma bond in the reactant of the hydrogenation of ethyne:



So the reaction is exothermic. The same is true for the hydrogenation of ethane:



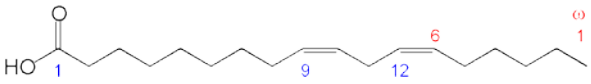
化學科 第三題參考答案

(1) 飽和脂肪酸 $CH_3(CH_2)_{16}COOH$

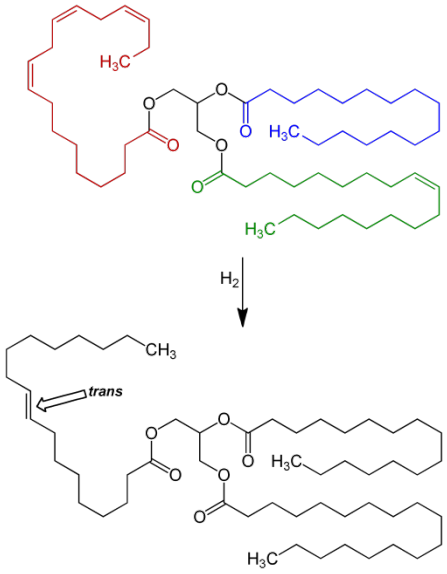
單元不飽和脂肪酸 $CH_3(CH_2)_n(CH=CH)(CH_2)_{14-n}COOH$ 譬如油酸 n=7

多元不飽和脂肪酸 $CH_3(CH_2)_n(CH=CH)_m(CH_2)_{16-n-2m}COOH(m>1)$。

(2) 18:2 (*n*-6)



(3)



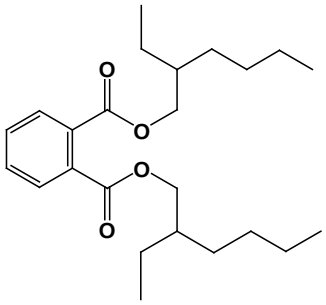
(4) 椰子油及氫化棉籽油的飽和脂肪酸含量都很高，不益於健康。

(5) 食用反式脂肪將會提高罹患冠狀動脈心臟病的機率，因為反式脂肪可使低密度脂蛋白上升，並使高密度脂蛋白下降。肝臟無法代謝反式脂肪，也是高血脂、脂肪肝的重要原因之一。世界各地的健康管理機構建議將反式脂肪的攝取量降至最低，美國最近已宣布禁售人造反式脂肪。

化學科 第四題參考答案

(1) 0.739/12 : 0.097/1.0 : 0.164/16 = 12 : 19 : 2，依命名應為 $C_{24}H_{38}O_4$

(2)



(3) DEHP 的化學式為 $C_6H_4(CO_2C_8H_{17})_2$，屬於鄰苯二甲酸與 2-乙基己醇生成的酯類化合物。它是最重要的鄰苯二甲酸酯，也是使用最廣和產量最大的塑化劑。由於 DEHP 俱有極性雙酯基以及非極性烷基和苯基，多樣的分子間作用力可作界面活性劑使用。成本低廉，常做為 PVC 塑膠的塑化劑。PVC 塑膠中 DEHP 的含量在 1%到 40%之間。DEHP 還可作為液壓油、電容器的介電質及螢光棒中的溶劑。

(世界衛生組織指出鄰苯二甲酸酯類進入人體和動物體內會有類似雌激素的作用，會干擾內分泌，是一種潛在的內分泌干擾物。長期暴露於 DEHP 環境下除了會促進女性第一和第二性徵的發育成熟作用，還會增加患上乳癌、子宮內膜癌的風險。美國國家環境保護局規定飲用水中 DEHP 的含量需小於 6 ppb。美國安全與衛生署（OSHA）規定工作環境空氣中，DEHP 含量的上限為 5mg/立方公尺。)