※注意：請於答案卷中作答。

Circle **the single answer in the [brackets] or the multiple answers in the {braces}; or *Answer* the questions or commands on the blank space below. 10% for each question: 1(A) to (E) & 2(A) to (E).**
於中括弧中圈選單選或於大括弧中圈選多選;或於空白處回答問題。每小題10分。

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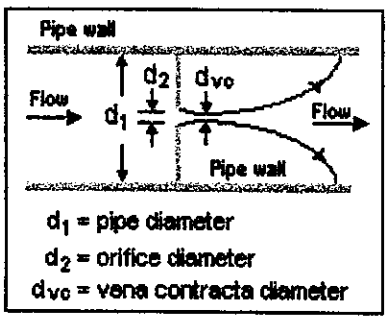
1. The canister of your camping stove contains 116 g of liquefied butane (C_4H_{10}) with a saturated pressure of 2.0 bar at 27°C and a combustion heat of -3.0 MJ/mol. Upon releasing the butane inside, the fuel was immediately ignited. (A) The reaction is an **{endothermic; endergonic; exergonic; exothermic}** reaction, the energy will be **[absorbed; released]** from the **[kinetic energy of molecules; potential energy stored in covalent bonds]**. When using a striker or match to ignite the butane, you are **[lowering the activation energy of the reaction; raising the kinetic energy of some molecules]**. (B) With one canister, **how many liters of water** can be heated to boiling from 40°C if the thermal efficiency was 42%? (1 cal=4.20J; the specific heat of liquid water is 1.000 cal/g°C). (C) Write down **the balanced reaction of complete combustion of butane**. (D) For gas constant=0.08 L·atm/K·mol, at 27°C, **how many liters of carbon dioxide** can be emitted after using up the canister? (E) Describe the possible trouble when the butane just released was not ignited immediately.

2. Continue from the question above. (A) If the heating rate was linearly related to the releasing rate of butane gas, the reaction followed **[zero; first; pseudo-first; second; pseudo-second]** order kinetic since the pressure of **[butane; carbon dioxide; oxygen; water vapor]** held constant. (B) The release of butane from the canister can be described by the orifice plate model as the following figure and the equation inset. **Which parameter** is the major controllable variable? Why? (C) Calculate ρ. (D) Describe the mechanism by which the **vena contracta** was formed. (E) Is the ignited canister safe or going to explode? Why?

Orifice Plate Model $Q = \frac{\pi}{4}\epsilon(d_2)^2 C_d \sqrt{\frac{2\rho P_d}{1-\beta^4}}$



from Wikipedia

Q: mass flow rate
ε: expansibility factor (1 for liquid, decreasing with pressure ratio across the orifice)
C_d: Coefficient of discharge (0.6~0.85 depending on the geometry of the orifice)
ρ: density of the fluid upstream
P_d: pressure difference across the orifice
β: diameter ratio, d_2/d_1

試題隨卷繳回