國立雲林科技大學 系別：環境與安全衛生工程系

96學年度轉學生招生考試試題 (四年制二, 三年級) 科目：物理及化學

1. (10%)

Nickel has a face-centered cubic unit cell. The density of nickel is 6.84 g/cm³. Calculate a value for the atomic radius of nickel. (Ni=58.69 g/mol)

2. (10%)

An excited hydrogen atom emits light with a frequency of 1.141×10^{4} Hz to reach the energy level for which n =4 . In what principal quantum level did the electron begin?

Hint: $\Delta E = -2.178\times10^{-18}(\frac{1}{n_f^2}-\frac{1}{n_i^2})$

3. (10%)

The enthalpy of vaporization of mercury is 59.1 kJ/mol. The normal boiling point of mercury is 372℃. What is the vapor pressure of mercury at 25℃?

4. (10%)

An iron ore sample contains Fe_2O_3 plus other impurities. A 652-g sample of impure iron ore is heated with excess carbon, producing 343 g of pure iron by the following reaction:(Fe=55.85)

$$Fe_2O_3(s)+3\,C(s)\rightarrow 2\,Fe(s)+3\,CO(g)$$

What is the mass percent of Fe_2O_3 in the impure iron ore sample? Assume that Fe_2O_3 is the only source of iron and that the reactions is 100% efficient.

5. (10%)

The bombardier beetle uses an explosive discharge as a defensive measure. The chemical reaction involved is the oxidation of hydroquinone by hydrogen peroxide to produce quinone and water:

$C_6H_4(OH)_{2(aq)} + H_2O_{2(aq)} \rightarrow C_6H_4O_{2\,(aq)} + 2H_2O_{(l)}$

Calculate $\triangle H$ for this reaction from the following data:

$C_6H_4(OH)_{2(aq)} \rightarrow C_6H_4O_{2(aq)} + H_{2(g)}$ $\quad \triangle H = +177.4$ kJ

$H_{2(g)} + O_{2(g)} \rightarrow H_2O_{2(aq)}$ $\quad \triangle H = -191.2$ kJ

$H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow H_2O_{(g)}$ $\quad \triangle H = -241.8$ kJ

$H_2O_{(g)} \rightarrow H_2O_{(l)}$ $\quad \triangle H = -43.8$ kJ

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6.(10%)

A playful astronaut releases a bowling ball, of mass m = 7.20 kg, into circular orbit about Earth at an altitude h of 350 km.

(a) What is the mechanical energy E of the ball in its orbit?

(b) What is the mechanical energy E_0 of the ball on the launchpad at Cape Canaveral? From there to the orbit, what is the change ΔE in the ball's mechanical energy?

7.(10%)

The cross-sectional area A_0 of the aorta (the major blood vessel emerging from the heart) of a normal resting person is 3 cm^2, and the speed v_0 of the blood through it is 30 cm/s. A typical capillary (diameter $\fallingdotseq 6\mu m$) has a cross-sectional area A of 3×10^{-7} cm^2 and a flow speed v of 0.05 cm/s. How many capillaries does such a person have?

8.(10%)

Figure 1. shows how the stream of water emerging from a faucet "necks down" as it falls. The indicated cross-sectional areas are $A_0 = 1.2$ cm^2 and $A = 0.35$ cm^2. The two levels are separated by a vertical distance h = 45 mm. What is the volume flow rate from the tap?

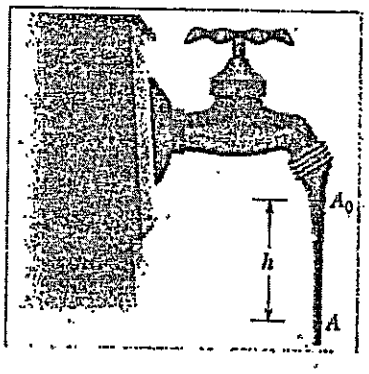

Fig. 1 . As water falls from a tap, its speed increases. Because the low rate must be the same at all cross sections, the stream must "neck down."

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9.(10%)
A uniform solid cylindrical disk, of mass M = 1.4 kg and radius R = 8.5 cm, rolls smoothly across a horizontal table at a speed of 15 cm/s. What is its kinetic energy K?

10.(10%)
You are given a length of uniform heating wire made of a Nickel–chromium–iron alloy called Nichrome; it has a resistance R of 72 W. At what rate is energy dissipated in each of the following situations? (1) A potential difference of 120 V is applied across the full length of the wire. (2) The wire is cut in half, and a potential difference of 120 V is applied across the length of each half.

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96學年度轉學生招生考試試題 (四年制二年級)

系別：環境與安全衛生工程系
科目：微積分

1. 試寫出 $f'(a)$ 的定義，並據此求 $f'(2)$，其中 $f(x)=\begin{cases} x[x], & x<2 \\ 2x-2, & x\geq 2 \end{cases}$ (10%)

2. 試求曲線 $f(x)=\dfrac{x^3}{x^2-3}$ 的截距、定義域、極大及極小值、+反曲點以及漸近線並繪圖形(15%)

3. $\Omega=\left\{(r,\theta)\middle| 0\leq r\leq 2\cos\theta, 0\leq\theta\leq\dfrac{\pi}{2}\right\}$ 求 $\iint_{\Omega}\sqrt{x^2+y^2}\,d\Omega$ (15%)

4. 試求下列積分值

(1) $\int\cos^3 x\sin^2 x\,dx$ (2) $\int x^2e^x\,dx$ (3) $\int\dfrac{dx}{x^2\sqrt{x^2+4}}$ (20%)

5. 求 $\dfrac{1}{\sqrt{(3.98)^2+(2.99)^2}}$ 近似值 (10%)

6. Find the area of the region bounded by the parabola $y^2=2x-2$ and the line $y=x-5$. (20%)

7. Find $f'(t)$ if $f(t)=\sqrt{4\sin^2 t+9\cos^2 t}$ (10%)