

اسس التصحيح - لمادة الفيزياء - شهادة الثانوية العامة فرع علوم الحياة - دورة ٢٠٠٤ الاستثنائية

**First exercise (6 pts.)**

1. The kinetic energy of the system (block , bullet) (1/4pt.)

2.  $\vec{P}_{\text{before}} = \vec{P}_{\text{after}}$  (1/4 pt)

$$m \vec{V}_0 = (M+m) \vec{V}_1 \quad (1/4 \text{ pt}) \quad \text{so : } V_1 = \frac{mV_0}{(M+m)} \quad (1/4 \text{ pt.})$$

3. a. M.E = P.E<sub>g</sub> + K.E (1/4pt.)

$$\text{M.E} = 0 + \text{K.E} = \frac{1}{2} (M+m) V_1^2 \quad (1/4\text{pt.})$$

$$\text{M.E} = \frac{1}{2} (M+m) \left[ \frac{mV_0}{(M+m)} \right]^2 = \frac{1}{2} \frac{m^2 V_0^2}{(M+m)} \quad (1/4 \text{ pt.})$$

b. M.E = (M+m)gh (1/4pt.)

$$h = \ell - \ell \cos \alpha = \ell (1 - \cos \alpha) \quad (1/2\text{pt})$$

$$\Rightarrow \text{M.E} = (M+m)g \ell (1 - \cos \alpha) \quad (1/4\text{pt.})$$

c. The mechanical energy of the system (block, bullet) is conserved because friction is neglected. (1/2pt.)

$$\frac{1}{2} \frac{m^2 V_0^2}{(M+m)} = (M+m)g \ell (1 - \cos \alpha)$$

$$V_0 = \frac{(M+m)}{m} \sqrt{2gl(1 - \cos \alpha)} \quad (1 \text{ pt.})$$

$$V_0 = 101.3 \text{ m/s} \quad (1/2 \text{ pt.})$$

4. K.E<sub>before</sub> = 1/2 m V<sub>0</sub><sup>2</sup> (1/4pt)

$$\text{K.E}_{\text{before}} = 102.6 \text{ J} \quad (1/4\text{pt})$$

$$\begin{aligned} \text{K.E}_{\text{after}} &= \frac{1}{2} (M+m) V_1^2 \\ &= \frac{1}{2} \frac{m^2 V_0^2}{(M+m)} \end{aligned} \quad (1/4\text{pt})$$

$$\text{K.E}_{\text{after}} = 2 \text{ J} \quad (1/4\text{pt})$$

K.E<sub>before</sub> > K.E<sub>after</sub> , the answer is verified. (1/4pt)

**Second exercise (7 pts.)**

A-

I. X is a capacitor because at the end of charging the current becomes zero (3/4)

2. Y is a resistor because the current remains constant. (3/4 pt)

3. Z is a coil because the current grows with a certain delay. (3/4 pt)

B-1.a) B = 10<sup>-4</sup> A / Hz (1 pt)

$$\text{b) Given : } i = \frac{dq}{dt} = \frac{C du_c}{dt}$$

$$i = C U \sqrt{2} 2\pi f \cos 2\pi ft$$

$$\Rightarrow i = I \sqrt{2} \cos 2\pi ft$$

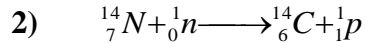
$$\Rightarrow I = 2\pi C U f = B f \Rightarrow B = 2\pi C U \quad (13/4\text{pt.})$$

$$\text{c) } C = B / 2\pi U = 10^{-4} / 2\pi = 16 \times 10^{-6} \text{ F} \quad (1/2 \text{ pt})$$

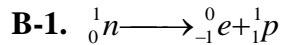
2.a) Current resonance (1/2 pt)

$$\text{b) } f_0 = \frac{1}{2\pi \sqrt{LC}} \quad (1/2 \text{ pt})$$

$$\Rightarrow L = 0.11 \text{ H.} \quad (1/2 \text{ pt})$$

**Third exercise (7 pts)****A-1)** the nuclei having the same charge number  $Z$  but different mass number  $A$ .**(1/2 pt.)****(3/4 pt.)**

3 The emitted particle is a proton (or hydrogen nucleus)

**(1/4pt.)****(3/4 pt.)**2. the binding energy of a nucleus of mass  $m$  is :  $E_l = \Delta m.c^2$ **(1/4pt.)**

with  $\Delta m = [Zm_p + (A-Z)m_n] - m_x$

**(1/4pt)**

the binding energy per nucleon is  $\frac{E_l}{A}$

**(1/4pt)**- for the nucleus  ${}^{14}_6C$  we have :

$$\Delta m = 6 \times 1.00728 + 8 \times 1.00866 - 14.0065$$

$$\Delta m = 0.10646 \text{ u} ; E_l = 99.16749 \text{ MeV}$$

$$\frac{E_l}{A} = 7.083 \text{ MeV}$$

**(1/2 pt)**- for the nucleus  ${}^{14}_7N$  we have ;

$$\Delta m = 7 \times 1.00728 + 7 \times 1.00866 - 14.0031$$

$$\Delta m = 0.10848 \text{ u} ; E_l = 101.04912 \text{ MeV}$$

$$\frac{E_l}{A} = 7,217 \text{ MeV}$$

**(1/2 pt)**3. We notice that the binding energy per nucleon of  ${}^{14}_7N$  is greater than that of  ${}^{14}_6C$  ; The nitrogen nucleus  ${}^{14}_7N$  is more stable than the carbon  ${}^{14}_6C$  nucleus . **(1/4pt)**

4.a)  $\lambda = \frac{0,693}{T}$  ;

**(1/4pt)**

$$\lambda = 1.244 \times 10^{-4} \text{ year}^{-1} = 3.94 \times 10^{-12} \text{ s}^{-1}$$

**(1/4pt)**

b) 
$$n = \frac{0.05 \times 6.02 \times 10^{23}}{14} = 215 \times 10^{19} \text{ nuclei}$$

**(1/2pt)**

c)  $A = \lambda \times n$  **(1/4 pt)** ;  $A = 8471 \times 10^{10} \text{ Bq.}$

**(1/4pt)**

C-  $A_0 = 200 \text{ dis./mn}$   $A = 20 \text{ dis./mn}$

$$A = A_0 e^{-\lambda t} \text{ (1/4pt)} ; t = \frac{\ln \frac{A_0}{A}}{\lambda} = 18509 \text{ years}$$

**(1pt)**