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- عناصر الإجابة -

RR 28E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي
المركز الوطني للتقويم والامتحانات والتوجيه

المادة	الفيزياء والكيمياء	مدة الإنجاز	3
الشعبة أو المسلك	مسلك العلوم الفيزيائية – خيار إنجليزية	المعامل	7

Exercise I (7 points)

	Questions	Answers	Marking scale	Question reference In the framework
Part I	1	The plate of copper represents the cathode and it is connected to the negative terminal of the power supply G.	0,5	-Recognise the anode electrode (oxidation) and the cathode electrode (reduction) using the flow of electric current imposed by an external voltage supply.
	2	$6H_2O_{(\ell)} \rightleftarrows O_{2(g)} + 4H_3O^+_{(aq)} + 4e^-$	0,5	- Write the half-equation that occurred in each electrode (use double arrows) and write the overall equation of the reaction during electrolysis (use one arrow).
	3	$m(Ag) \approx 1,9\,g$	0,75	- Establish the relationship between the amounts of substance of chemical specie produced or consumed, the current intensity and the operating duration of electrolysis. Use this relationship to determine other quantities (quantity of charge, progress of the reaction, change of the mass, volume of a gas, etc.).
Part II	1	- By this process the reaction does not still occurring.	0,25	- Justify the different operations carried out during the monitoring of the time-evolution of a system and exploit the experimental results.
	2	Name of each component.	3x0,25	- Know the experimental set-up of an acid-base titration.
	3	$n_0(\text{alcohol}) = n_0(acid) = 0,6\,mol$	0,5	- Determine the composition of reaction mixture at a given time.
	4	The equation of the esterification reaction	0,5	- Write the esterification and the hydrolysis equation.
	5	$n_{eq}(acid) = n_{eq}(alcohol) = 0,2\,mol$ $n_{eq}(ester) = n_{eq}(water) = 0,4\,mol$	0,25x4	- Determine the composition of reaction mixture at a given time.
	6	the value of the equilibrium constant is $K = 4$	0,5	- Know that, the reaction quotient in equilibrium $Q_{r,eq}$, associated to the reaction equation of a chemical system, takes a value independent of concentrations, called equilibrium constant K.

	7	✓ Method used to determine the final progress rate at equilibrium ✓ the yield of the reaction expression ✓ $r \approx 93\%$	**0,5** **0,25** **0,25**	- Calculate the yield of a chemical transformation.
	8	The equation of the chemical reaction between ethanoic anhydride and ethanol	**0,75**	- Write the equation of the reaction of an anhydrous acid with an alcohol and that of the basic hydrolysis of an ester.

	Exercise II (3 points)			
	Questions	**Answers**	**Marking scale**	**Question reference In the framework**
Part I	**1**	-Method $-\lambda \approx 8.10^{-7}$ m	**0,75** **0,25**	-Know (Recall) and exploit the relationship $\theta = \lambda / a$; and know the units and the meaning of θ and λ. - Exploit experimental measurements to verify the relationship $\theta = \lambda / a$.
	2	Because of the wavelength of the violet is lower than λ , so the width of the central spot decreases.	**0,5**	
Part II	**1**	- Particle X : an electron -The type of the radioactivity of the $^{60}_{27}Co$ nucleus : β^-	**0,25** **0,25**	- Define the radioactivity: α , β^+ & β^- and the $\gamma - radiation$. - Write the equation of a nuclear reaction by applying the two conservation laws.
	2	- Expression - $E_{pro} = 2,82$ MeV	**0,25** **0,25**	- Calculate the energy released (produced) by a nuclear reaction: $E_{pro} = \lvert \Delta E \rvert$.
	3	$\mathscr{E} = 8,78$ MeV / nucleon . The nucleus $^{60}_{28}Ni$ is the most stable	**0,25** **0,25**	- Define and calculate the binding energy per nucleon and exploit it.

Exercise III (4,5 points)			
Questions	**Answers**	**Marking scale**	**Question reference In the framework**
1.1	Connect the datalogger to monitor the voltage $u_C(t)$	**0,25**	Know how to connect an oscilloscope and a datalogger to monitor different voltages.
1.2	$\frac{du_c}{dt}+\frac{1}{RC}u_c=\frac{E}{RC}$	**0,5**	- Find out the differential equation and verify its solution when the RC dipole is submitted to a step voltage.
1.3	$A=E$ $\tau=RC$	**0,25** **0,25**	- Determine the voltage expression $u_C(t)$ between capacitor's terminals when the RC dipole is submitted to a step voltage, and deduce both the expression of the intensity current in the circuit and the capacitor's charge.
1.4	$C=100\,\mu F$ $R_2=60\,\Omega$	**0,25** **0,25**	- Know and exploit the time-constant expression. - Exploit experimental documents in order to: * recognize the observed voltages. * highlight the influence of R and C on the charging and the discharging processes. *determine the time-constant and charge duration.
1.5	We accept answers like : -The time-constant increases with the resistance and vice-versa. -The time-constant is proportional to the resistance value.	**0,5**	
2.1	$\frac{d^2q}{dt^2}+\frac{1}{LC}q=0$	**0,5**	- Find out the differential equation for the voltage between the capacitor's terminals or for its charge $q(t)$ in the negligible damping case and verify its solution. - Know and exploit the expression of the charge $q(t)$ and deduce the current's intensity expression $i(t)$ flowing in the circuit and exploit it. - Know and exploit the natural period expression.
2.2	- Method $T_0=2\pi\sqrt{LC}$	**0,25** **0,25**	
2.3	$T_0=60\,ms$ -The value of the inductance L of the inductor studied is $L\approx 0,91\,H$	**0,25** **0,25**	
2.4	$\mathscr{E}_{tot1}=1,8\,mJ$ $\mathscr{E}_{tot2}=1,8\,mJ$ The total energy keeps the same value with time.	**0,5** **0,25**	- Know and exploit the expression of the total energy in the circuit.

	Exercise IV (5,5 points)			
	Questions	**Answers**	**Marking scale**	**Question reference In the framework**
Part I	**1**	$F_{s/b} = G.\frac{M_s.m_b}{r_b^2}$	**0,5**	- Know the universal gravitation law in its vectorial form.
	2.1	- Method -Uniform motion	**0,5** **0,25**	- Apply the Newton's second law to the centre of mass of a satellite or of a planet to determine the type of motion or one of parameters that characterizes the motion.
	2.2	Establish the Kepler third law	**0,75**	Find Kepler's third law in the case of circular trajectory.
	2.3	$M_S = \frac{4\pi^2}{K.G}$ $M_S \approx 2,15.10^{30}\ kg$	**0,25** **0,25**	- Apply the Newton's second law to the centre of mass of a satellite or of a planet to determine the type of motion or one of parameters that characterizes the motion. - Apply Kepler's three laws in the case of a circular trajectory.
Part II	**1**	$X_m = 6\,cm$ $T_0 = 0,4\,s$ $\varphi = 0$	**0,25** **0,25** **0,25**	- Know the meaning of the physical quantities involved in the expression of the parametric equation $x_G(t)$ of the oscillating system (solid-spring) and determine them using the initial conditions.
	2	- Method $E_m = 3,6.10^{-2}\ J$	**0,5** **0,25**	- Know and exploit the expression of the mechanical energy of a solid-spring system.
	3	- Method $E_{K1} = 3,6.10^{-2}\ J$	**0,5** **0,25**	- Exploit the conservation and the non-conservation of the mechanical energy of a solid-spring system.
	4	- Method $W_{AB}(\vec{F}) = -9\,mJ$	**0,5** **0,25**	- Know and exploit the relation between the work of a force applied by a spring and the elastic potential energy change.