الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة الاستدراكية 2021
- عناصر الإجابة -

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

3h	مدة الإنجاز	الفيزياء والكيمياء	المادة
7	المعامل	شعبة العلوم التجريبية مسلك العلوم الفيزيائية (خيار إنجليزية)	الشعبةأو المسلك

EXERCISE1 (7 points)

Question			Answers	Marking scale	Question reference in the framework
Part 1	I	1)	1 = pH-meter ; 2 = burette 3 = methanoic acid solution ; 4 = Sodium hydroxide solution	4x0,25	- Write the equation of titration reaction (use only one arrow) - Know the experimental set-up of an acid-base titration. - Exploit the curve or the results of the titration. - Determine and exploit the point of equivalence. - Write the equation of the acid-base reaction and identify the two pairs involved. - Calculate the final progress of the reaction that occurs between an acid and water taking into consideration the value of both the concentration and this acid's pH aqueous solution; then, compare it with the maximum progress. - Give and use the expression of the reaction quotient Q_r through the reaction equation. - Know that, for a given transformation, the final progress rate depends on the equilibrium constant and the initial state of the chemical system. - Write and use the expression of the acid dissociation constant K_A associated with the reaction of an acid with water. - Know the relationship $pK_A = -\log K_A$. - Indicate the predominant chemical specie taking into consideration pH of aqueous solution and pK_A of pair acid/base.
		2)	$AH_{(aq)} + HO^-_{(aq)} \rightarrow A^-_{(aq)} + H_2O_{(\ell)}$	0,5	
		3)	$V_{bE} = 15\,mL$	0,25	
		4)	$C_a = \frac{C_b . V_{bE}}{V_a}$ $C_a = 10^{-1}\,mol.L^{-1}$	0,25 0,25	
	II	1)	$AH_{(aq)} + H_2O_{(\ell)} \rightleftarrows A^-_{(aq)} + H_3O^+_{(aq)}$	0,5	
		2.1)	Method $\frac{[A^-]}{[AH]} = 4,35.10^{-2}$	0,5	
		2.2)	AH is predominant	0,25	
		3)	Method $pK_A \approx 3,74$	0,25 0,25	
	III	1)	Method	0,25	
		2)	$\tau_1 = 0,1$: $C_1 = 1,58.10^{-2}\,mol.L^{-1}$ $\tau_2 = 0,4$: $C_2 = 6,28.10^{-4}\,mol.L^{-1}$	0,25 0,25	
		3)	τ increases with dilution	0,25	
Part 2		1)	The oxidation occurs at the electrode of nickel+ justification	0,25 0,25	- Draw a cell diagram / diagram of an electrochemical cell (battery) - Interpret the functioning of a battery based on: the direction of electric current flow, the electromotive force (emf), the electrode reactions, the polarity of electrodes or the movement of charge carriers. - Write the half-equation that occurred in each electrode (use double arrows) and write the overall equation of the reaction during the battery functioning (use one arrow). - Establish the relationship between the amount of substance of chemical specie produced or consumed, the current intensity and the operating duration of a battery. Use this relationship to determine other quantities (quantity of charge, progress of the reaction, change of the mass...).
		2)	$Ni_{(s)} + 2\,Ag^+_{(aq)} \rightarrow Ni^{2+}_{(aq)} + 2\,Ag_{(s)}$	0,5	
		3)	$\Delta t = \frac{2\,F\,m}{I\,M(Ni)}$ $\Delta t = 8,94\,h$	0,25 0,25	
		4)	$[Ni^{2+}] = C_1 + \frac{n(Ni)}{V}$ $[Ni^{2+}] = 2,17.10^{-1}\,mol.L^{-1}$	0,25 0,25	

EXERCISE II (2 points)			
Question	**Answers**	**Marking scale**	**Question reference in the framework**
1.1)	False	**0,25**	- Define a mechanical wave and its wave speed. - Define a transverse wave and a longitudinal wave. - Define a progressive wave. - Exploit experimental documents and data in order to determine: * distance; * time delay; * wave speed. - Suggest a scheme of experimental set-up (mounting) to measure time delay or to determine the wave speed during the wave propagation. - Recognize a periodic progressive wave and its period.
1.2)	True	**0,25**	
1.3)	False	**0,25**	
1.4)	True	**0,25**	
2.1)	Method $v = 5000\,m.s^{-1}$	**0,5** **0,25**	
2.2)	Aluminium	**0,25**	

EXERCISE III (2,5points)			
Question	**Answers**	**Marking scale**	**Question reference in the framework**
1)	$^{32}_{15}P \rightarrow {}^{0}_{-1}e + {}^{32}_{16}S$ Daughter nucleus : $^{32}_{16}S$	**0,25** **0,25**	-Know the meaning (significance) of the symbol $^{A}_{Z}X$ and give the corresponding composition of the nucleus. - Know and exploit the two laws of conservation. - Define the radioactivity: α , β^+ & β^- and the γ *radiation* . - Write the equation of a nuclear reaction by applying the two conservation laws. - Recognize the type of radioactivity using the equation of a nuclear reaction. - Know and exploit the law of the radioactive decay, and exploit its curve. - Exploit the relationships between τ , $t_{1/2}$ and λ (decay constant).
2.1)	Method	**0,5**	
2.2)	Method $\lambda = 4,85.10^{-2}\,days^{-1}$	**0,25** **0,25**	
2.3)	Method	**0,25**	
3)	Method $a_1 \approx 2,6.10^{7}\,Bq$	**0,5** **0,25**	

EXERCISE IV (5,5points)

Question		Answers	Marking scale	Question reference in the framework
I-	1)	Method	0,25 0,25	- Know and exploit the relationship $i=\frac{dq}{dt}$ for a capacitor in receiver convention. - Know and exploit the relationship q = C.u. - Know the capacitance of a capacitor, its unit F and their submultiples $\mu F, nF \text{ and } pF$. - Determine the capacitance of a capacitor graphically or by calculation. - Find out the differential equation and verify its solution when the RC dipole is submitted to a step voltage. - Recognize that the voltage between capacitor terminals is a continuous function of time at t=0, and the current intensity is a discontinuous function at t=0. - Know and exploit the time-constant expression. - Exploit experimental documents in order to: *determine the time-constant and charge duration. - Know how to connect an oscilloscope and a datalogger to monitor different voltages.
	2)	Method	0,5	
	3)	Method $\tau = R_1.C$	0,25 0,25	
	4)	$\tau = 12\,ms$ Checking the value of C	0,25 0,25	
II-	1)	Experimental set-up	0,25	- Suggest the scheme of the experimental assembly that allows studying the response of the RL dipole which is submitted to a step voltage. - Know and exploit the voltage expression $u = r.i + L.\frac{di}{dt}$ between the inductor (coil) terminals using the receiver convention. - Determine the two characteristics of the inductor (the inductance L, the resistance r) exploiting experimental results. - Find out the differential equation and verify its solution when the RL dipole is submitted to a step voltage. - Determine the current intensity expression $i(t)$ when the RL dipole is submitted to a step voltage, and deduce the voltage expressions between the inductor terminals and the resistor terminals. - Recognize and represent the variation curves of current intensity $i(t)$ in terms of time across the inductor and different physical quantities associated to it, and exploit them. - Know and exploit the time-constant expression. - Exploit experimental documents in order to *determine the time-constant.
	2)	Method $\tau = \frac{L}{R_2 + r}$	0,25 0,25	
	3)	Method $I_p = \frac{E}{R_2 + r}$	0,25 0,25	
	4)	Method $r = 5\,\Omega$	0,25 0,25	
	5)	Check the value of L	0,25	
III-	1)	Curve (a) : R_3 Curve (b) : R_4	0,25 0,25	- Define and recognize the undamped (periodic), the underdamped (pseudo-periodic) and the overdamped (non-periodic) states. - Know and exploit the natural period expression. - Know and exploit the energetic diagrams. - Know and exploit the expression of the total energy in the circuit. - Find out the differential equation for the voltage between the capacitor terminals or for its charge $q(t)$ in the damping case. - Exploit experimental documents in order to: * recognize the observed voltages; * recognize the damping states; * determine the values of the period and the natural period.
	2)	$T = 45\,ms$; $T \approx T_0$ $T_0 = 44,87\,ms$	0,25 0,25	
	3)	Method $\Delta E_t = -0,54\,mJ$	0,25 0,25	

EXERCISE V (3points)			
Question	**Answers**	**Markings cale**	**Question reference in the framework**
1)	$\frac{dv_x}{dt}=0$ $\frac{dv_y}{dt}=-g$	**0,25** **0,25**	Know Newton's second law $\sum\vec{F}_{ex}=m.\frac{\Delta\vec{V}_G}{\Delta t}$ and $\sum\vec{F}_{ex}=m.\vec{a}_G$ and its range of validity. Apply Newton's second law to find out the differential equation of a system's centre of inertia motion in horizontal or inclined plane and determine the characteristics of kinetic and dynamic quantities of motion. - Exploit a document representing the path (trajectory) of a projectile in a uniform gravitational field to: * determine the type of the motion (plane); * represent the velocity and the acceleration vectors; * determine the initial conditions and some parameters characterizing motion. - Apply Newton's second law in the case of a projectile to: * find out differential equation of motion; * deduce the parametric equations of motion and exploit them; * establish the equation of the path (trajectory), find out the expressions of the range and the maximum height of the pathand exploit them; - Exploit the velocity-time graph: $v_G=f(t)$. - Select the appropriate frame of reference to study motion.
2)	$v_x(t)=V_0.\cos\alpha$ $v_y(t)=-g.t+V_0.\sin\alpha$	**0,25** **0,25**	
3.1)	Method $g=10\,m.s^{-2}$	**0,25** **0,25**	
3.2)	Method $\alpha\approx 4,9°$	**0,25** **0,25**	
3.3)	Method $V_0\approx 69,96\,m.s^{-1}$	**0,25** **0,25**	
4)	Method $V_E\approx 69,91\,m.s^{-1}$	**0,25** **0,25**	

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