وزارة التربية والتعليم العالي	امتحانات الشهادة الثانوية العامة	دورة العام 2023 الاستثنائية
المديرية العامّة للتربية	فرعا: الاجتماع والاقتصاد والآداب والإنسانيات	السبت 26 آب 2023
دائرة الامتحانات الرسميّة		

| مسابقة في الثقافة العلمية: مادة الفيزياء | الاسم: |
| المدة: ساعة واحدة | الرقم: |

This exam is formed of three obligatory exercises in two pages.
The use of non-programmable calculator is recommended.

Exercise 1 (7 pts)

Water Jump

During summer, Jad practices an aquatic and sports activity called "Water Jump". During this activity, Jad slides on a track ABC, situated in a vertical plane and formed of a wet slide AB which ends with a curved board BC. When he leaves the curved board at point C, Jad performs a jump in air; he reaches point D and then dives into water.

The aim of this exercise is to study the motion of Jad during this activity.

Jad, considered as a particle of mass

m = 64 kg, starts from rest at point A situated at a height h_A above the surface of the ground passing through B (Doc. 1).

Assume that friction and air resistance are negligible.

Take:
- the horizontal plane passing through B as the reference level for gravitational potential energy of the system (Jad, Earth);
- g = 10 m/s².

1) Choose with justification the correct answer.
   1.1) When Jad slides from A to B, its kinetic energy:
      a) remains the same   **b)** decreases   **c)** increases
   1.2) When Jad leaves the curved board at point C and during its motion between C and D, its kinetic energy:
       a) remains the same   **b)** decreases   **c)** increases

2) The table below shows the gravitational potential energy of the system (Jad, Earth) at positions A, B, C and D.
   Copy and complete the table below with the suitable position for each gravitational potential energy. Justify your answer.
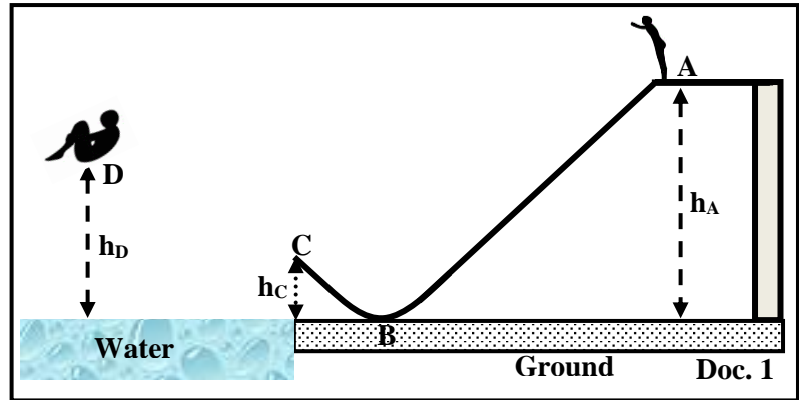
GPE (J)	0	384	960	1920
Position				

3) Show that h_A = 3 m and h_C = 0.6 m.
4) Deduce the value of the mechanical energy of the system (Jad, Earth) at A.
5) Determine, by applying the principle of conservation of the mechanical energy, the speed of Jad at C.

Exercise 2 (7 pts)

Air Pollution in Lebanon
Read carefully the following selection, and then answer the questions.

In Lebanon, all our power plants are located on the coast, where there is the highest population density. They operate with heavy oil, one of the dirtiest and most polluting fossil fuels in the world. As these power plants are not sufficient, the lack is filled by private generators, installed between the buildings and run on diesel; it is another big source of pollution and diseases.

The populations of the region more vulnerable to infections by viruses with respiratory problems. What we are asking the Lebanese government to do is to move consistently and quickly towards renewable energies, such as wind or solar power, especially in a country where we have more than 300 days of sunshine a year. In this way, Lebanon will be able to save money, create jobs, protect our health and environment.

France info (2020)

Doc. 2

Questions

1) Document 2 is about air pollution in Lebanon. Pick out from document 2:
   1.1) the two main causes of this pollution;
   1.2) the effect of this pollution on health.

2) The table below contains three pollutant gases in the atmosphere; each of these gases causes a harmful effect. Copy and complete the table, by associating each polluting gas with one of the following harmful effects: greenhouse effect, reduce the blood's ability to carry oxygen, bronchitis.

Polluting gas	Harmful effect
Sulfur dioxide	
Carbon monoxide	
Carbon dioxide	

3) Document 2 proposes to the government to use renewable energies: "wind" and "solar".
   3.1) The above renewable energies are originated from one source of energy. Name this source.
   3.2) Pick out from document 2, a specific characteristic of Lebanon which shows that one of the two energies is suitable for better performance.
   3.3) Pick out from document 2, two advantages of using these renewable energies.

Exercise 3 (6 pts)

Electric motor of a toy
Batteries of total voltage 4.5 V feed a motor in a toy. The electric motor transforms most of the electrical energy into useful energy (Doc. 3).

Electric motor of a toy

Useful energy: E — Consumed energy: $E_{electric}$

Doc. 3
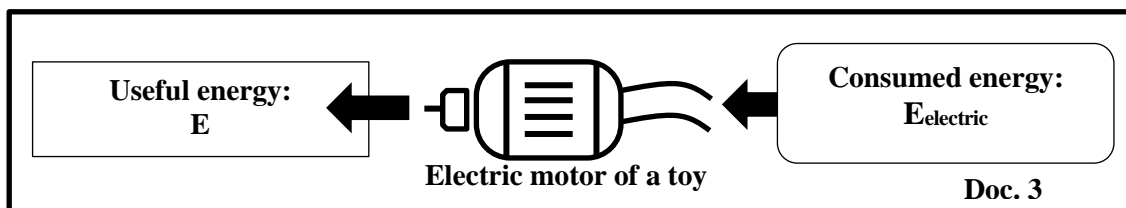
1) In what form do batteries store energy before transforming it into electrical energy?

2) A current $I = 0.05$ A passes through the electric motor in 1 minute. Calculate, in Joules, the electric energy « $E_{electric}$ » consumed by the motor in 1 minute.

3) The electric motor furnishes a useful energy $E = 12$ J in 1 minute.

Calculate the efficiency « r » of the electric motor, knowing that $r = \dfrac{\text{Useful energy}}{\text{Consumed energy}}$.

4) Calculate the quantity of the dissipated energy during this transformation of energy in the electric motor.

5) In what form is it dissipated?

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مسابقة في مادة الفيزياء
أسس التصحيح – انكليزي

Part	Exercise 1 (7 pts) Water Jump	Note
1.1	c) When Jad slides from A to B, its kinetic energy increases, because: $ME_A = ME_B$ then $KE_A + GPE_A = KE_B + GPE_B$; $0 + GPE_A = KE_B + 0$ therefore $KE_B > KE_A$ __Or__: between A and B, GPE decreases and since $ME_A = ME_B$ then KE increases.	1
1.2	b) When Jad leaves the curved board at point C and during its motion between C and D, its kinetic energy decreases because: No air resistance so $ME = KE + GPE = $ constant. As Jad moves from C to D the height increases so the GPE increases , hence KE decreases.	1
2	<table><tr><td>GPE (J)</td><td>0</td><td>384</td><td>960</td><td>1920</td></tr><tr><td>Position</td><td>B</td><td>C</td><td>D</td><td>A</td></tr></table> $GPE_B = 0$ J because reference level for gravitational potential energy passes through B. GPA_A is the greatest value, since A is the highest point from the reference level. $h_C < h_D$; $GPE = mg\, h$ then $GPE_C < GPE_D$	1 1
3	$GPE_A = 1920$ J , But $GPE_A = m\, g\, h_A$, so $1920 = 64 \times 10 \times h_A$, hence $h_A = \frac{1920}{640}$; $h_A = 3$ m $GPE_C = 384$ J , But $GPE_C = m\, g\, h_C$, so $384 = 64 \times 10 \times h_C$, hence $h_C = \frac{384}{640}$; $h_C = 0.6$ m	0.5 0.5
4	$ME_A = KE_A + GPE_A$, but $KE_A = 0$ $(V_A = 0)$ so $ME_A = GPE_A = 1920$ J	1
5	$ME_A = ME_C$ therefore $ME_A = KE_C + GPE_C$ $1920 = \frac{1}{2} \times 64 \times V_C^2 + 384$, thus $V_C = 6.9$ m/s $\cong 7$ m/s	1

Part	Exercise 2 (7 pts) Air Pollution in Lebanon	Note
1.1	power plants \ private generators (or: heavy oil \ diesel)	1
1.2	infections by viruses with respiratory problems	1
2	<table><tr><td>Polluting gas</td><td>Harmful effect</td></tr><tr><td>Sulfur dioxide</td><td>bronchitis</td></tr><tr><td>Carbon monoxide</td><td>reduce the blood's ability to carry oxygen</td></tr><tr><td>Carbon dioxide</td><td>greenhouse effect</td></tr></table>	1.5
3.1	The Sun	0.5
3.2	__Solar power__: especially in a country where we have more than 300 days of sunshine a year.	1
3.3	to save money / create jobs /protect our health and environment.	2

Part	Exercise 3 (6 points) Electric motor of a toy	Note
1	Chemical energy	1
2	$E_{electric} = U\, I\, t$ so $E_{electric} = 4.5 \times 0.05 \times 60 = 13.5$ J	2
3	$r = \dfrac{\textbf{Useful energy}}{\textbf{Consumed energy}}$; so $r = \dfrac{12}{13.5} = 0.88 = 88$ %	1
4	Dissipated energy $= 13.5 - 12 = 1.5$ J	1
5	Thermal energy or Heat energy	1