



SCIENTIFIC-TECHNOLOGICAL FIELD ACADEMIC STUDIES OPTION

*FREE TESTS FOR OBTAINING THE TITLE OF
GRADUATE OF COMPULSORY SECONDARY EDUCATION
INTENDED FOR PEOPLE OVER EIGHTEEN YEARS OLD*

Resolution of December 23, 2021 (B.O.C.M. of January 10, 2022)

APPLICANT'S INFORMATION	QUALIFICATION
LAST NAMES: NAME: D.N.I. / N.I.E.: BIRTHDATE: EXAM DATE: EXAM LOCATION:	

First call for applications, 2022

INSTRUCTIONS

- The maximum duration of the exercise will be 1 hour 30 minutes.
- Keep your ID card/Foreigner's Identification Number (NIE) in a visible place on the table.
- You will need to have your mobile phone off during the test.- The use of calculators, dictionaries, or electronic resources is not permitted.- Read the texts, questions, or statements carefully. First, do the exercises you feel most confident about solving.
- Pay attention to the presentation and write the answer or process in an organized manner.- Once you have finished the test, review it meticulously before handing it in.

(TO BE FILLED IN BY THE PROOFREADER)											
QUESTIONS	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Total
PUNTUACIÓN											



Dirección General
de Educación Secundaria,
Formación Profesional
y Régimen Especial
CONSEJERÍA DE EDUCACIÓN,
UNIVERSIDADES, CIENCIA
Y PORTAVOCÍA

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1. Calculate the result of the following expressions, indicating the intermediate steps to obtain the final result. Also, the final result of section **a)** Express it as a simplified fraction and the final result of section **b)** Express it in scientific format.

a)

$$\frac{1}{\left(\frac{2}{3}\right)^{-1} + \frac{1}{\frac{1}{4}} + 1/0,25} =$$

(0,50 puntos)

b)

$$\frac{1}{2} \cdot 2,4 \cdot 10^7 : (1,1 \cdot 10^{-5})^2 =$$

(0,50 puntos)

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LAST NAMES: NAME: ID/NIE:

2. In a store, the price of a one-liter bottle of oil undergoes the following evolution:

<i>week 1</i>	<i>Week 2</i>	<i>Week 3</i>
Price per bottle: €4	The price increases by 10% compared to the previous week's price.	The price increases by 10% compared to the previous week's price.

Calculate:

a) The price of a bottle of oil in the third week. **(0.50 points)**

b) The percentage increase in the price of the bottle from the first week to the third week.

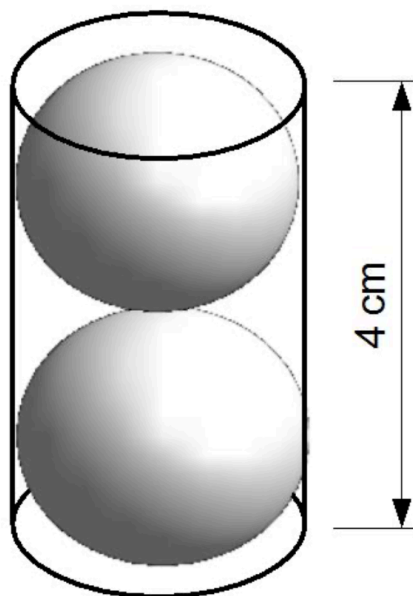
(0.50 points)

APPLICANT'S INFORMATION

LAST NAMES:

NAME: ID/NIE:

3. A company manufactures spherical bearings with a radius of 1 cm; to sell them, they place them in oil, two at a time, in small cylindrical containers as shown in the following drawing:



Knowing that the volume of a cylinder is given by the expression $V_{\text{cilindro}} = \pi \cdot r^2 \cdot h$, where r is the radius of the base of the cylinder and h the height of the same, and knowing, also, that the volume of a sphere is given by $V_{\text{esfera}} = \frac{4}{3} \cdot \pi \cdot r^3$, where r is the radius of the sphere. Find, expressing the result in liters, the amount of oil needed to package 6000 bearings. Consider $\pi \approx 3,14$. (1 point)

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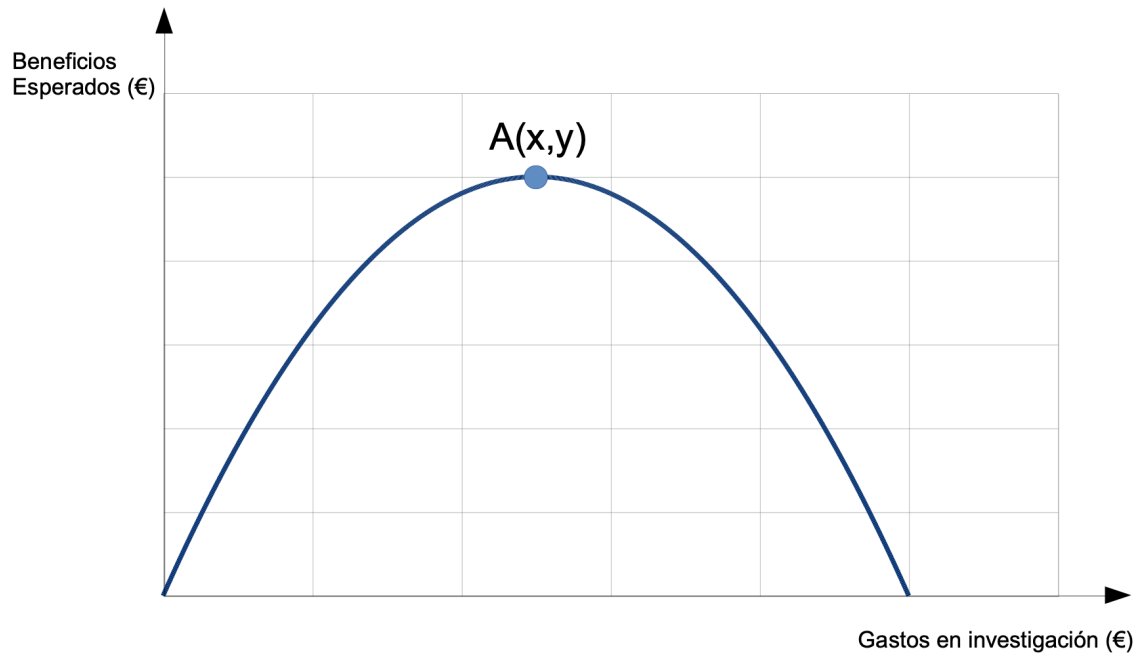
NAME: ID/NIE:

4. The expected annual profits of a small business, based on the

$$y = -\frac{1}{25\,000}x^2 + 4x$$

This graph has been created from the function

The research expenses incurred by this same company during a year are shown in the graph below.



According to the information provided:

a) Find the coordinates of point A. **(0.50 points)**



APPLICANT'S INFORMATION

LAST NAMES:

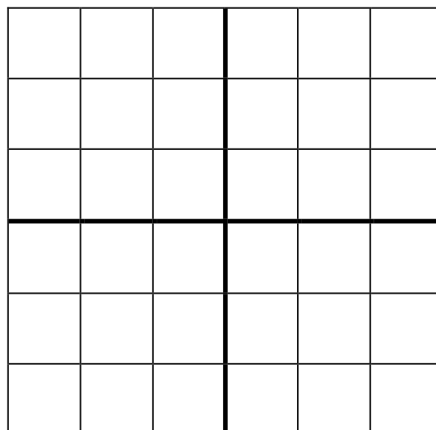
NAME: ID/NIE:

b) What are the research expenditure values that correspond to an expected benefit of zero euros?

(0.50 points)

5. Let the line containing the point $(2,1)$ and having a slope be $m = 2$. **a)** Write the equation for it. ***(0.50 points)***

b) Plot this line on the coordinate axes given below. ***(0.50 points)***





APPLICANT'S INFORMATION

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NAME: ID/NIE:

6. In a bicycle and other sustainable mobility vehicle repair shop, the time it took to repair a series of vehicles was analyzed, obtaining the following table:

<i>Time in minutes (statistical variable)</i>	<i>Number of vehicles (Absolute frequency)</i>
[0-30)	10
[30-60)	20
[60-90)	10

a) Using the class mark of each interval, find the mean of the statistical variable.

(0.25 points)

b) Starting from the class mark of each interval, find the standard deviation of the statistical variable, expressing the final result in the form of a radical.

(0.50 points)



APPLICANT'S INFORMATION
LAST NAMES: NAME: ID/NIE:

- c) After conducting this study, a vehicle enters the workshop to be repaired. What is the probability that it will take less than one hour to fix this vehicle? **(0.25 points)**

7. Between the ends of a conductor there is a potential difference of 850 V. The current flowing through this conductor is 2 A.

- a) What is the resistance that this conductor offers to the passage of current?

(0.50 points)

- b) What is the power? **(0.50 points)**



APPLICANT'S INFORMATION
LAST NAMES: NAME: ID/NIE:

8. A solution is prepared with 5 g of sodium hydroxide in 25 g of distilled water. If the final volume is 27 mL, calculate the concentration of the solution in:

a) Percentage by mass. **(0.50 points)** b) Grams per liter. **(0.50 points)**



APPLICANT'S INFORMATION

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9. Identify the concept or term that corresponds to each definition:

(0.10 points per section; total 1 point)

	Definition Concept
Area where the nerve impulse enters a neuron.	
The duct that runs through the penis and carries sperm to the outside. It is part of the excretory system.	
The male gonads are two organs that produce sperm and male sex hormones. They are enclosed in a pouch of skin called the scrotum.	
Hormone responsible for female secondary sexual characteristics.	
Muscular organ that will house the fetus during pregnancy.	
The outer, anterior, and transparent layer of the human eye.	
It protects the brain. It is made up of flat bones joined by immovable joints.	
Areas of contact between bones. They can be fixed, like those of the skull, mobile, like those of the knee or elbow, or with little mobility, like those of the hip.	
It is made up of muscles and tendons.	
Gamete or female reproductive cell.	

10. Indicate the correct answer in the table at the end of the exercise for each of the following questions:

1. What is true about fossils?

- a. They are the remains of living beings that lived in past times.
- b. That they are all remains of the hard parts of the organism (bones, shells, etc.).
- c. That can appear in any type of rock.
- d. That they are always animal remains (including oil).

(0.25 points)

2. What is true about the structure of the Earth?

- a. The deeper we go, the less pressure there is and the more temperature there is, so the core is in a completely molten state.
- b. The lithosphere is a solid and rigid layer, divided into plates.
- c. The crust includes the lithosphere.
- d. There are no convective currents in the endosphere.

(0.25 points)

3. The theory of continental drift:

- a. It was formulated after the discovery of seafloor spreading.
- b. It correctly states that the continents move due to the forces of gravity and the attraction of the Earth and the Moon.
- c. Consider convection currents as the driving force behind the movement of the continents.
- d. It speaks of a supercontinent (Pangea) that broke apart over time.

(0.25 points)

4. In subduction zones:

- a. The lithospheric plates are moving apart.
- b. These are areas with high volcanism and seismicity.
- c. Transformation failures are characteristic.
- d. They are areas with upward convective currents.

(0.25 points)

Answers:

1	2	3	4

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CORRECTION AND GRADING CRITERIA, AND SOLUTIONS TO THE
PROPOSED QUESTIONS

Instructions The use of calculators, dictionaries, or electronic resources is not permitted.

Qualification: The maximum score for each question is 1 point. To achieve this score, in addition to correct answers, the clarity of the explanation, the justification of the reasoning, and the calculations will be assessed. Other processes used by the examinee will be considered valid, without prejudice to the marking criteria set out in each question.

1. Calculate the result of the following expressions, indicating the intermediate steps to obtain the final result. Also, the final result of section **a)** Express it as a simplified fraction and the final result of section **b)** Express it in scientific format.

a) (0.50 points) $\left(\frac{2}{3}\right)^{-1} + \frac{1}{4} + \frac{1}{0,25} =$

1
1

2

$$3 + 4 + 4$$

=1

$$8 + \frac{2}{3} = 1$$

24 + 2

3

$$= 1: \frac{26}{3} = \frac{3}{26}$$

Correct solution and development:
0.50 points. Otherwise: 0 points.

Page1 of 10



b) (0.50 points)

1

$$2 \cdot 2,4 \cdot 10^7 : (1,1 \cdot 10^{-5})^2 = 1,2 \cdot 10^7 : [1,1^2 \cdot (10^{-5})^2] = 1,2 \cdot 10^7 : 1,21 \cdot 10^{-10} = 0,99 \cdot 10^{17} = 9,9 \cdot 10^{16}$$

Correct solution and development: 0.50 p.
In other cases: 0 p.

2. In a store, the price of a one-liter bottle of oil undergoes the following evolution:

week 1	Week 2	Week 3
Price per bottle: €4	The price increases by 10% compared to the previous week's price.	The price increases by 10% compared to the previous week's price.

Calculate:

a) The price of a bottle of oil in the third week. (0.50 points)

$$4 \text{ €} \cdot 1,1 \cdot 1,1 = 4,84 \text{ €}$$

Correct solution and development: 0.50 p.
In other cases: 0 p.

b) The percentage increase in the price of the bottle from the first week to the third week. (0.50 points)

$$\text{Price increase} = \text{€}4.84 - \text{€}4 = \text{€}0.84$$

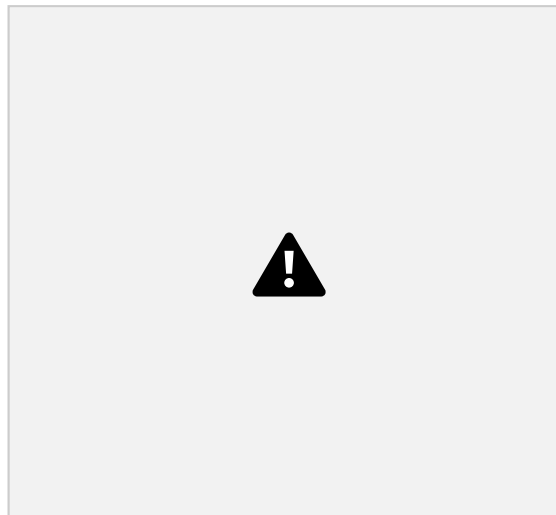
0,84 €

$$4 \text{ €} \cdot 100\% = \frac{84}{4}\% = 21\%$$

Correct solution and development: 0.50 p.
 In other cases: 0 p.



3. A company manufactures spherical bearings with a radius of 1 cm; to sell them, they place them in oil, two at a time, in small cylindrical containers as shown in the following drawing:



Knowing that the volume of a cylinder is given by the expression $V_{\text{cylinder}} = \pi \cdot r^2 \cdot h$, where r is the radius of the base of the cylinder and h the height of the same, and knowing, also, that the volume of a sphere is given by $V_{\text{sphere}} = \frac{4}{3} \cdot \pi \cdot r^3$, where r is the radius of the sphere. Find, expressing the result in liters, the amount of oil needed to package 6000 bearings. Consider $\pi \approx 3,14$. **(1 point)**

Required packaging:

$$\frac{6000 \text{ bearings}}{2 \text{ bearing per container}} = 3000 \text{ containers}$$

$$\begin{aligned}
 \text{Oil} &= 3000 \cdot (4 \cdot 10^3 \cdot 10^3 \cdot (1 \cdot 10^3)^2 - 2 \cdot 10^4 \cdot 10^3 \cdot (1 \cdot 10^3)^3) = 3000 \cdot (4 \cdot 10^9 \cdot 10^3 - 2 \cdot 10^7 \cdot 10^9) \\
 &= 3000 \cdot (4 \cdot 10^{12} - 2 \cdot 10^{16}) = 3000 \cdot (4 \cdot 10^{12} - 20 \cdot 10^{12}) \\
 &= 3000 \cdot (-16 \cdot 10^{12}) = -48 \cdot 10^{15}
 \end{aligned}$$

Unit conversion:

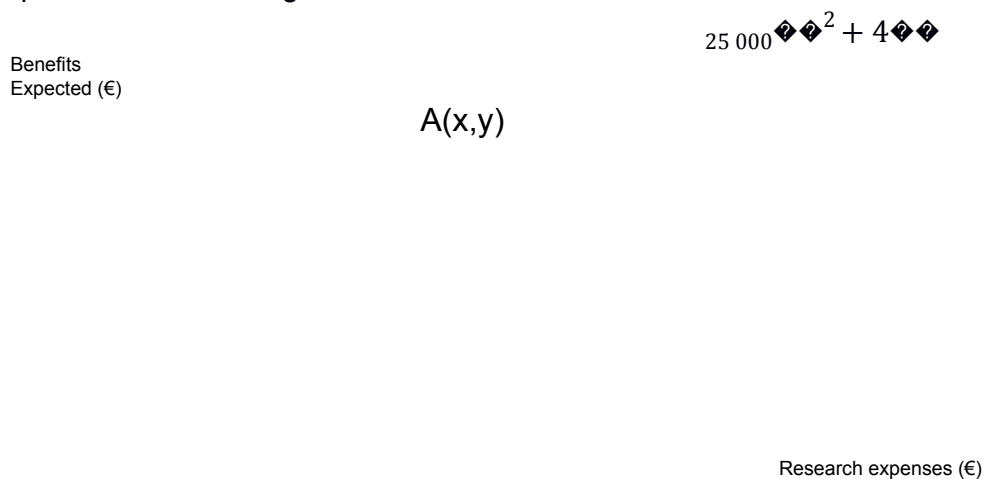
$$\begin{aligned}
 &12\,560 \cdot 10^3 \cdot 10^3 \cdot 10^3 \\
 &1000 \cdot 10^3 = 12,56 \cdot 10^6 \equiv 12,56 \cdot 10^6
 \end{aligned}$$

Correct solution and development: 1 pt.
 Correct approach and incorrect solution: 0.50 p.
 In other cases: 0 p.



4. The expected annual profits of a small business, based on the research expenses incurred by the business during a year, are shown in the graph below.

This graph was created using the function $A(x) = -2x^2 + 4x + 25\,000$



According to the information provided:

a) Find the coordinates of point A. (0.50 points)

$$\begin{aligned}
 2x^2 - 4x + 25\,000 &= 0 \\
 x &= \frac{4 \pm \sqrt{16 - 4 \cdot 2 \cdot 25\,000}}{2 \cdot 2}
 \end{aligned}$$

$$z = 2 \cdot 25\,000 = 50\,000 \text{ €}$$

A (50 000 €, 100 000 €)

*Correct solution and development: 0.50 p.
In other cases: 0 p.*

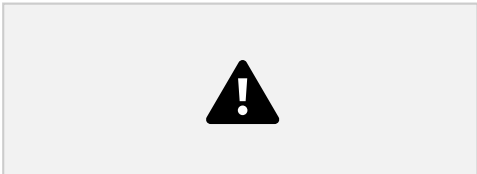
b) What are the research expenditure values that correspond to an expected benefit of zero euros? (0.50 points)

By symmetry, $x=0\text{€}$, $x=100\,000 \text{ €}$

The equation can also be solved:

$$\begin{array}{l}
 x^2 + 4x = 0 \rightarrow x(x+4) = 0 \rightarrow \{x = 0, -4\} \\
 25\,000 x^2 + 4x = 0 \rightarrow x(x+4) = 0 \rightarrow \{x = 0, -1\} \\
 25\,000 x + 4 = 0 \rightarrow x = -\frac{4}{25\,000}
 \end{array}$$

Page 4 of 10



*Correct solution and development: 0.50 p.
In other cases: 0 p.*

5. Let the line containing the point (2,1) and having a slope $m = 2$. a) Write the equation for it. (0.50 points)

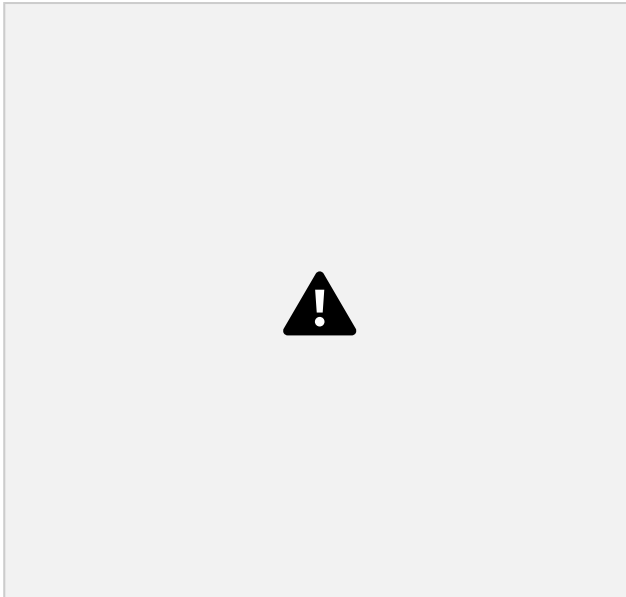
*Correct solution and development (in this solution manual the point-slope equation is proposed as the answer, but any other way of expressing it correctly will be considered valid): 0.50 p.
In other cases: 0 p.*

b) Plot this line on the coordinate axes given below. (0.50 points)

$$(y - 1) = 2 \cdot (x - 2); y - 1 = 2x - 4; y = 2x - 3$$

x	and
0	-3
2	1

Based on this table:



Correct solution and development: 0.50 p.
In other cases: 0 p.

Page5 of 10



6. In a bicycle and other sustainable mobility vehicle repair shop, the time it took to repair a series of vehicles was analyzed, obtaining the following table:

<i>Time in minutes (statistical variable)</i>	<i>Number of vehicles (Absolute frequency)</i>
[0-30)	10
[30-60)	20
[60-90)	10

a) Using the class mark of each interval, find the mean of the statistical variable. **(0.25 points)**

<i>Classes</i>	<i>x_i</i>	<i>f_i</i>	<i>$x_i \cdot f_i$</i>
[0-30)	15	10	150
[30-60)	45	20	900
[60-90)	75	10	750
Totals		40	1800

$$\diamond\diamond = 1800$$

$$40 = 45$$

Correct solution and development: 0.25 p.

In other cases: 0 p.

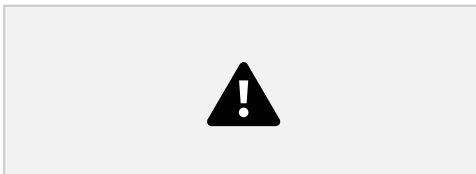
b) Starting from the class mark of each interval, find the standard deviation of the statistical variable, expressing the final result in the form of a radical. **(0.50 points)**

Using the expression:

$$\diamond\diamond = \sqrt{\sum \diamond\diamond \cdot \diamond\diamond^2 - \diamond\diamond^2}$$

Classes	x_i	f_i	x_i^2	$f_i \cdot x_i^2$
[0-30)	15	10	225	2250
[30-60)	45	20	2025	40500
[60-90)	75	10	5625	56250
Totals		40		99000

Page 6 of 10



$$\diamond\diamond = \sqrt{99\,000}$$

$$40 - 45^2 = \sqrt{450}$$

Perfect solution and development: 0.50 points.

Good approach and bad solution: 0.25 points.

Otherwise: 0 points.

c) After conducting this study, a vehicle enters the workshop to be repaired. What is the probability that it will take less than one hour to fix this vehicle? **(0.25 points)**

$$(\text{Take less than an hour}) = 30$$

$$\frac{30}{40} = \frac{3}{4} = 0,75$$

Correct solution and development: 0.25 p.

In other cases: 0 p.

7. Between the ends of a conductor there is a potential difference of 850 V. The current flowing through this conductor is 2 A.

a) What is the resistance that this conductor offers to the passage of current?(0.50 points)

We apply Ohm's Law:

$$\Delta V = I \cdot R$$

$$850 \text{ V} = 2 \text{ A} \cdot R$$

We solve for the resistance, R: $R = 425 \Omega$

Correct answer: 0.50 points.

Correct solution without expressing units: 0 points.

Incorrect answer: 0 points.

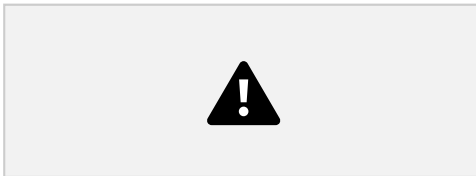
b) What is the power?(0.50 points) $P = \Delta V \cdot I$

$$P = 850 \text{ V} \cdot 2 \text{ A} = 1700 \text{ W}$$

Correct answer: 0.50 points.

Correct solution without expressing units: 0 points.

Page 7 of 10



Incorrect answer: 0 points.

8. A solution is prepared with 5 g of sodium hydroxide in 25 g of distilled water. If the final volume is 27 mL, calculate the concentration of the solution in:

a) Percentage by mass.(0.50 points) $5 \text{ g} + 25 \text{ g} = 30 \text{ g}$

$$\frac{5 \text{ g}}{30 \text{ g}} \cdot 100 = 16,67\%$$

$$\frac{5 \text{ g}}{30 \text{ g}} \cdot 100 = 16,67\%$$

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$$\frac{5 \text{ g}}{30 \text{ g}} \cdot 100 = 16,67\%$$

$$\frac{5 \text{ g}}{30 \text{ g}} \cdot 100 = 16,67\%$$

Correct answer: 0.50 points.

Correct solution without expressing units: 0 points.

Hormone responsible for female secondary sexual characteristics.	ESTROGENS
Muscular organ that will house the fetus during pregnancy.	UTERUS/MATRIX
The outer, anterior, and transparent layer of the human eye.	CORNEA
It protects the brain. It is made up of flat bones joined by immovable joints.	SKULL
Areas of contact between bones. They can be fixed, like those of the skull, mobile, like those of the knee or elbow, or with little mobility, like those of the hip.	JOINTS
It is made up of muscles and tendons.	MUSCULAR SYSTEM
Gamete or female reproductive cell.	OVUM

10. Indicate the correct answer in the table at the end of the exercise for each of the following questions:

1. What is true about fossils?

- a. They are the remains of living beings that lived in past eras.
- b. That they are all remains of the hard parts of the organism (bones, shells, etc.).
- c. That can appear in any type of rock.
- d. That they are always animal remains (including oil).

(0.25 points)

2. What is true about the structure of the Earth?

- a. The deeper we go, the less pressure there is and the more temperature there is, so the core is in a completely molten state.
- b. The lithosphere is a solid, rigid layer, divided into plates.
- c. The crust includes the lithosphere.
- d. There are no convective currents in the endosphere.

(0.25 points)



3. The theory of continental drift:

- a. It was formulated after the discovery of seafloor spreading.
- b. It correctly states that the continents move due to the forces of gravity and the attraction of the Earth and the Moon.
- c. Consider convection currents as the driving force behind the movement of the continents.
- d. It speaks of a supercontinent (Pangea) that broke apart over time. **(0.25)**

points)

4. In subduction zones:

- a. The lithospheric plates are moving apart.
- b. These are areas with high volcanism and seismicity.
- c. Transformation failures are characteristic.
- d. They are areas with upward convective currents.

(0.25 points)

Answers:

1	2	3	4
a	b	d	b

Note: Each correct answer is worth 0.25 points.