This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls — Loueizeh - Baabda

Stage Exam 05
27APR2026

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	10B and 10C
Teacher :	Mrs. Aya Al Mawla
Duration :	1 hour
Answer on a separate squared sheet.	

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

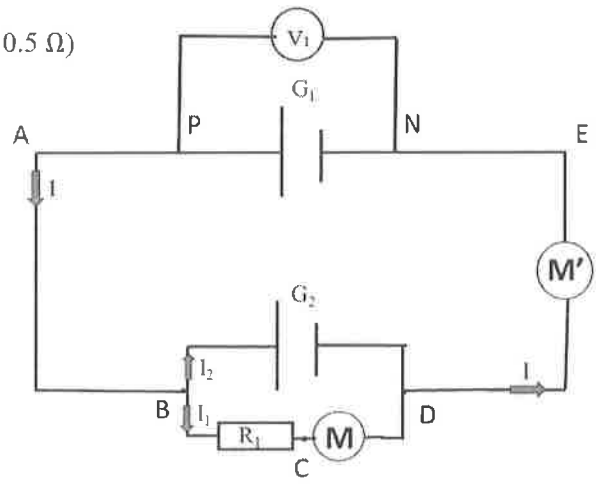
- **Exercise 1:** *(10pts)*

Electric Circuits

Given the following circuit composed of:

- Two generators G_1(13V, 1Ω), G_2(7V, 1 Ω)
- Two receivers (motors) M (e, 1 Ω), M' (4V, 0.5 Ω)
- A Resistor $R_1 = 10\,\Omega$.
- A voltmeter V_1

Given that the voltmeter reads 12V.



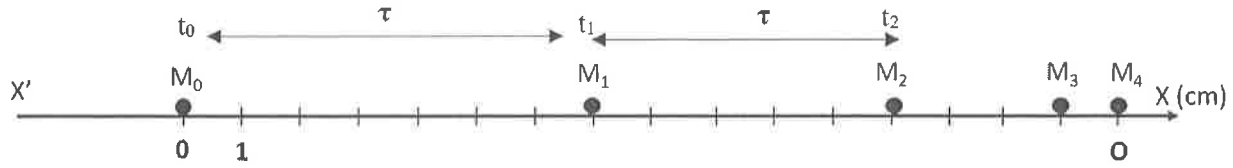
1. Which generator acts as a receiver? *Justify your answer.* *(2pts)*
2. Determine the value of the current ***I*** passing through the circuit. *(1pt)*

   Assume that the main current I passing through the circuit is 1A.
3. Calculate the voltage V_{DE} across the motor ***M'***. *(1pt)*
4. Using the law of addition of voltages in the circuit, deduce the voltage V_{BD}. *(1pt)*
5. Determine the value of the current I_2. *(1pt)*
6. Deduce the value of the current I_1. *(1pt)*
7. Calculate the voltage V_{BC} across the resistor R_1. *(1pt)*
8. Deduce the voltage V_{CD} across the Motor ***M***. *(1pt)*
9. Show that the value of the back electromotive force ***e*** of the motor M is **2V.** *(1pt)*

- **Exercise 2:** *(10pts)*

Rectilinear Motion

The figure below shows some successive positions of a particle (M) along the x-axis, where each two consecutive positions are separated by a constant time interval $\tau = \mathbf{100ms}$.



1- What is the direction of the motion? *(0.5pt)*

2- Give the expressions of the position vectors $\vec{r}_1$, $\vec{r}_2$, $\vec{r}_3$, and $\vec{r}_4$ at instants t_1, t_2, t_3 and t_4 respectively. *(1pt)*

3- Calculate the average speed V_{04} between the instants t_1 and t_4. *(1pt)*

4- Determine the instantaneous speeds V_1, V_2, and V_3 at instants t_1, t_2, and t_3 respectively. *(1.5pt)*

5- Deduce if (M) is in accelerating or decelerating motion. Justify your answer. *(1pt)*

6- Calculate the average acceleration a_{13} between t_1 and t_3. *(1pt)*

7- Determine the instantaneous acceleration a_2 at t_2. *(0.5pt)*

8- Give the expression of the instantaneous acceleration vector $\vec{a}_2$ at t_2. *(1pt)*

9- Give the expression of the instantaneous velocity vector $\vec{V}_2$ at t_2. *(1pt)*

10- Represent $\vec{a}_2$ and $\vec{V}_2$ on the x-axis using an appropriate scale. *(1.5pts)*

SE05 / 10 BC / 2025 2026 (/20)

- Exercise 1:

1- G_2 acts as a receiver (1) since it has a lower electromotive force. (1)

$E_2 = 7V < E_1 = 13V$. (2 pts)

2- $V_{PN} = 12V$ (voltmeter)

$V_{PN} = V_{G_1} = E_1 - r_1 I$ (0.5)

$12 = 13 - I$

$I = 13 - 12$

$\boxed{I = 1A}$ (0.5) (1 pt)

3- $V_{DE} = e + r I$ (0.5)

$= 4 + 0.5(1)$

(0.5) (1 pt)

$\boxed{V_{DE} = 4.5\ V.}$

4- $V_{BD} = ?$

Law of addition of voltages:

(0.25) $V_{PN} = V_{PA} + V_{AB} + V_{BD} + V_{DE} + V_{EN} = 12V$

(0.25) (connecting wires)

$V_{BD} + 4.5 = 12\ V$

$V_{BD} = 12 - 4.5$ (0.5)

$\boxed{V_{BD} = 7.5V}$ (1 pt)

5- $V_{G_2} = V_{BD} = 7.5\ V$ (0.25)

$V_{G_2} = E_2 + r_2 I_2 = 7.5\ V$. (0.25)

$I_2 = \frac{7.5 - E_2}{r_2} = \frac{7.5 - 7}{1}$ (0.5)

(1 pt)

$\boxed{I_2 = 0.5\ A}$

6- $I_1 = ?$

Junction at B. (0.5)

$\Sigma I_{in} = \Sigma I_{out}$

$I = I_1 + I_2$

$1 = 0.5 + I_1$ (0.5)

$I_1 = 1 - 0.5$

(1 pt)

$\boxed{I_1 = 0.5\ A}$

7- $V_{BC} = R_1 I_1$ (ohm's law)

$= 10\,(0.5)$

(1 pt)

$\boxed{V_{BC} = 5\ V}$

8- $V_{CD} = ?$

Law of addition of voltages in a series:

$V_{BD} = V_{BC} + V_{CD}$ (0.5)

$7.5 = 5 + V_{CD}$

$V_{CD} = 7.5 - 5$

$\boxed{V_{CD} = 2.5\ V}$ (0.5)

(1 pt)

9- $V_{CD} = e + r \cdot I_2 = 2.5$ (0.5)

$e = 2.5 - 0.5(1)$

$\boxed{e = 2\ V.}$ (0.5)

(1 pt)

- Exercise 2.

$\tau = 100\ ms \div 1000 = 0.1\ s$

1- Positive direction. (0.5)

2- $\vec{r_1} = 7\vec{i}$
$\vec{r_2} = 12\vec{i}$
$\vec{r_3} = 15\vec{i}$
$\vec{r_4} = 16\vec{i}$ (1 pt : 0.25 pt each)

3- $V_{04} = \dfrac{\| \Delta \vec{r}_{04} \|}{\Delta t_{04}}$ (0.25)

$V_{04} = \dfrac{16 - 0}{4\tau} = \dfrac{16\ cm}{4\tau} = \dfrac{16 \div 100\ m}{4(0.1)} = \dfrac{0.16}{0.4}$ (0.5)

$\boxed{V_{04} = 0.4\ m/s}$ (0.25) (1 pt)

4- $V_1 = V_{02}$; $V_2 = V_{13}$; $V_3 = V_{24}$ (0.25)

$V_1 = \dfrac{\| \Delta \vec{r}_{02} \|}{\Delta t_{02}} = \dfrac{12\ cm}{2\tau} = \dfrac{12 \div 100}{2(0.1)} = 0.6\ m/s$ (0.25)

$\boxed{V_1 = 0.6\ m/s}$

$V_2 = \dfrac{\| \Delta \vec{r}_{13} \|}{\Delta t_{13}} = \dfrac{8\ cm}{2\tau} = \dfrac{8 \div 100}{2(0.1)} = 0.4\ m/s$

$\boxed{V_2 = 0.4\ m/s}$

$V_3 = \dfrac{\| \Delta \vec{r}_{24} \|}{\Delta t_{24}} = \dfrac{4\ cm}{2\tau} = \dfrac{4 \div 100}{2(0.1)} = 0.2\ m/s$

$\boxed{V_3 = 0.2\ m/s}$ (1.5 pts) 0.5 pt each

5- The inst. speed is decreasing ; So the particle is slowing down (decelerating motion) (0.5) (0.5) (1 pt)

6- $a_{13} = \dfrac{V_3 - V_1}{t_3 - t_1}$ (0.25) (0.5)

$a_{13} = \dfrac{0.2 - 0.6}{2(0.1)} = \dfrac{-0.4}{0.2} = -2\ m/s^2$.

$\boxed{a_{13} = -2\ m/s^2}$. (0.25) (1pt)

7- $a_2 = a_{13}$ (0.5)

so $\boxed{a_2 = -2\ m/s^2}$.

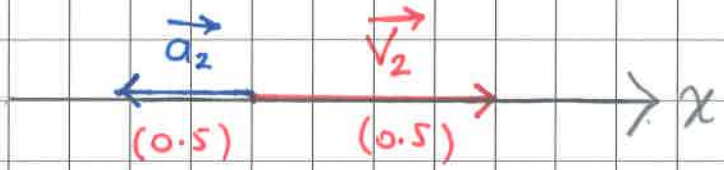
8- $\vec{a_2} = -2\,\vec{i}$ (m/s^2) (1pt)

9- $\vec{V_2} = 0.4\,\vec{i}$ (m/s) (1pt)

10-

Scale: $1\ cm = 1\ m/s^2$

(0.5) $1\ cm = 0.1\ m/s$.



(1.5 pts)