College of Sciences
Department of Physics & Astronomy

كلية العلوم
قسم الفيزياء والفلك

Final Exam Academic Year 1445 H – 1st Semester	الامتحان النهائي العام الدراسي ١٤٤٥هـ - الفصل الأول	40

Exam Information		معلومات الامتحان	
Course name:	**General Physics II**	فيزياء عامة - ٢	اسم المقرر:
Course code:	**104 PHYS**	١٠٤ فيز	رمز المقرر:
Exam date:	**Wednesday 13/12/2023 G**	الأربعاء ٢٩ /٠٥/ ١٤٤٥ هـ	تاريخ الامتحان:
Exam time:	**01:00 PM**	٠١:٠٠ مساء	وقت الامتحان:
Exam duration:	**3 Hours**	٣ ساعات	مدة الامتحان:

Student Information		معلومات الطالب/ـة
Student's name:		اسم الطالب/ـة:
Student ID no.:		الرقم الجامعي:
Section no.:		رقم الشعبة:
Roll no.:		رقم التحضير:
Exam room no.:		رقم قاعة الامتحان:
Lecturer's name:		اسم أستاذ/ة المقرر:

The exam consists of 32 QUESTIONS and 7 PAGES (including the cover page and the graph sheet)

All answers are given in MKS (unless the unit is stated)

Physical Constants

$k_e = 9\times10^9\ \mathrm{N\cdot m^2\cdot C^{-2}}$	$\epsilon_0 = 8.85\times10^{-12}\ \mathrm{C^2\cdot N^{-1}\cdot m^{-2}}$	$\mu_0 = 4\pi\times10^{-7}\ \mathrm{T\cdot m\cdot A^{-1}}$	$\lvert e\rvert = 1.6\times10^{-19}\ \mathrm{C}$
$g = 9.8\ \mathrm{m\cdot s^{-2}}$	$N_A = 6.02\times10^{23}\ \mathrm{mol^{-1}}$	$m_e = 9.1\times10^{-31}\ \mathrm{kg}$	$m_p = 1.67\times10^{-27}\ \mathrm{kg}$

Choose the letter of the correct answer and write it in CAPITAL LETTER in the appropriate box

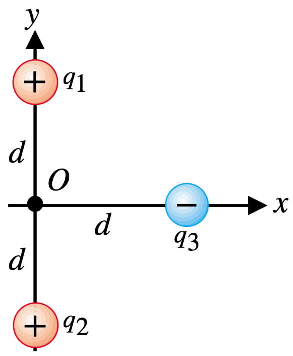
1	2	3	4	5	6	7	8	9	10	11	12
B	A	B	D	C	A	B	D	C	A	B	C

13	14	15	16	17	18	19	20	21	22	23	24
D	D	C	A	D	C	D	A	D	B	C	B

25	26	27	28	29	30	31	32
C	A	B	A	C	A	D	B

#	Questions	(1.25 marks for each)

01. Three-point charges are arranged as shown in the figure, where $q_1 = +6\ \mu C$, $q_2 = +9\ \mu C$, $q_3 = -3\ \mu C$ and $d = 2$ m. The magnitude of the resultant electric field at the origin O in (kN/C) unit equals:



A. 6.75 B. 9.55 C. 13.50 D. 19.09

02. In the ***previous question*** **(Q.01)**, the angle of the resultant electric field at the origin counterclockwise with respect to the positive x-axis in (°) unit equals:

A. 45 B. 135 C. 205 D. 295

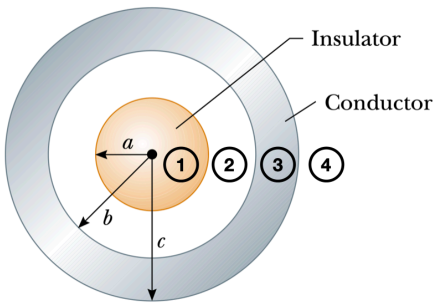
03. A proton is accelerated from rest in the direction of a uniform electric field $E = 150$ N/C as shown in the figure. The final speed of the proton when it travels a distance $l = 0.4$ m in the direction of the electric field in (km/s) unit is: [ignore any gravitational effects]

A. 93 B. 107 C. 111 D. 144

04. The total flux through an insulating solid sphere (radius = 0.2 m) is 12 $N \cdot m^2/C$. The charge per unit volume within the sphere in (nC/m^3) unit is:

A. 1.06 B. 1.84 C. 2.37 D. 3.17

05. A solid, insulating sphere of radius a has a uniform charge density ρ and a total charge Q. Concentric with this sphere is an uncharged, conducting hollow sphere whose inner and outer radii are b and c, as shown in the figure. The electric field vanishes in the region labelled with the number:

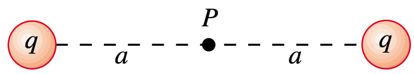


A. 1 B. 2 C. 3 D. 4

06. The electric field just above a large flat insulated sheet is 175 N/C. If the surface area of the sheet is $A = 5\ cm^2$, then the total charge of the sheet in (pC) is:

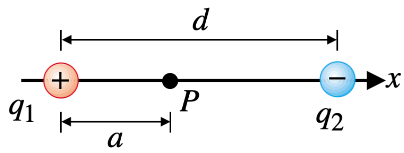
A. 1.55 B. 2.25 C. 2.75 D. 3.10

07. Consider two identical charged particles each with a charge q arranged as shown in the figure. If the electric potential at the point P is V_p, then the magnitude of each of the charges is:



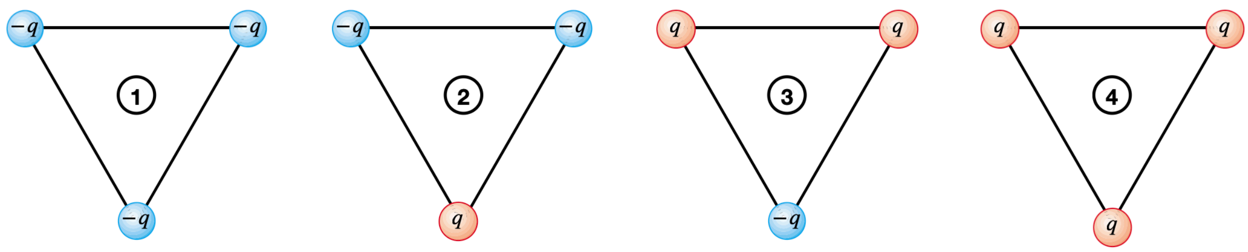
A. $\dfrac{V_p a^2}{2k_e}$ B. $\dfrac{V_p a}{2k_e}$ C. $\dfrac{V_p a}{k_e}$ D. $\dfrac{V_p a^2}{k_e}$

08. Two-point charges lie along the x-$axis$ and are arranged as shown in the figure, where $q_1 = 5$ C, $q_2 = -15$ C, and $d = 4$ m. The electric potential equals $zero$ at the point P when the distance a in (m) unit equals:



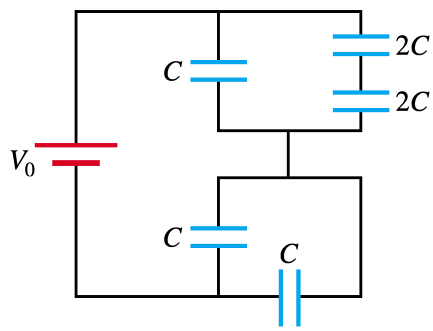
A. 0.25 B. 0.5 C. 0.75 D. 1

09. The figures below show four arrangements of charged particles placed at the vertices of an equilateral triangle. The arrangements with the lowest electric potential energy are:



A. diagrams 1 and 2. B. diagrams 3 and 4. C. diagrams 2 and 3. D. diagrams 1 and 4.

10. The equivalent capacitance (C_{eq}) of the capacitors shown in the figure is:



A. C B. $2C$ C. $3C$ D. $4C$

11. A series combination of two capacitors, $C_1 = 18\ \mu$F and $C_2 = 36\ \mu$F, are connected in to a 12-V battery. The energy stored in the capacitor C_1 in (μJ) unit will be:

A. 288 B. 576 C. 856 D. 1728

12. A parallel combination of two identical capacitors, C_1 and C_2, are connected to a battery. If we insert a dielectric slab (with $\kappa = 2$) between the plates of the capacitor C_1, then at equilibrium:

A. $\Delta V_1 = 2\Delta V_2$ B. $\Delta V_1 = \dfrac{\Delta V_2}{2}$ C. $Q_1 = 2Q_2$ D. $Q_1 = \dfrac{Q_2}{2}$

13. An ion beam with 20 mA current strikes a plate. If 1.875×10^{18} ions strike the plate each minute, then the charge of each ion in (C) unit is:

A. 1.6×10^{-19} B. 3.2×10^{-19} C. 4.8×10^{-19} D. 6.4×10^{-19}

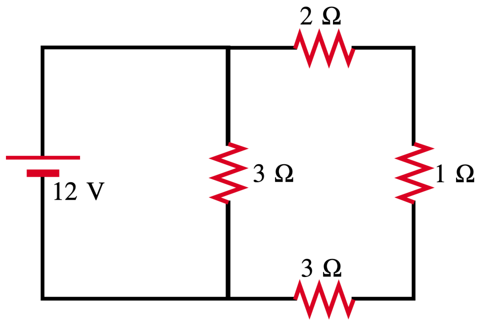
14. If a current density of $6 \times 10^{7}\ \text{A/m}^2$ exists in a metal with resistivity of $10 \times 10^{-8}\ \Omega \cdot \text{m}$, then the electric field in the metal in (N/C) unit is:

A. 1 B. 2 C. 4 D. 6

15. A 96-W power adapter has output voltage of 20.5 V. The current delivered by the adapter in (A) unit is:

A. 1.9 B. 3.8 C. 4.7 D. 5.7

16. For the circuit shown in the figure, the power delivered to the 1 Ω resistance in (W) unit is:

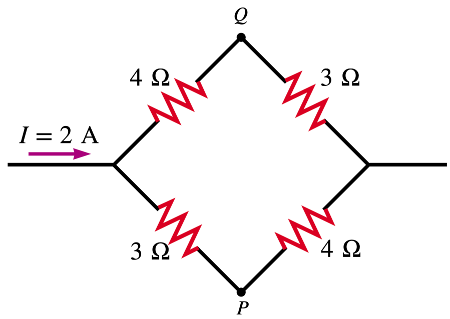


A. 4 B. 12 C. 24 D. 48

17. A parallel combination of two equal length wires made from the same material with different cross sectional area are connected to a battery. If $A_1 > A_2$ then:

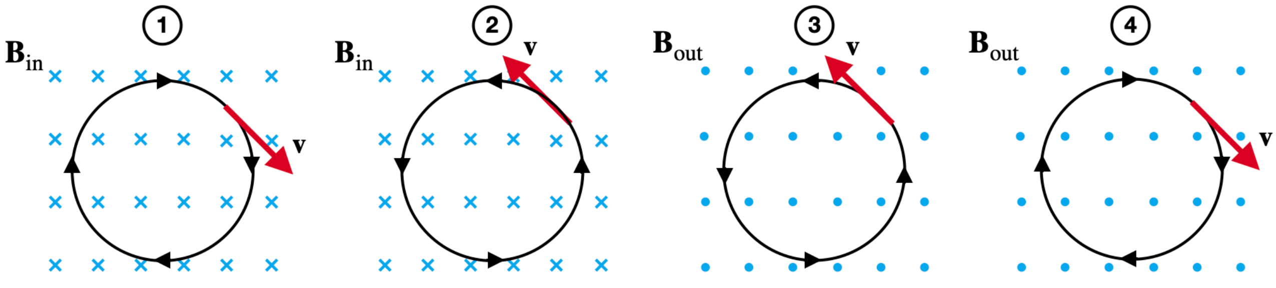
A. $\Delta V_1 < \Delta V_2$ B. $\Delta V_1 > \Delta V_2$ C. $I_1 < I_2$ D. $I_1 > I_2$

18. For the circuit shown in the figure, the current running through point Q in (A) unit is:



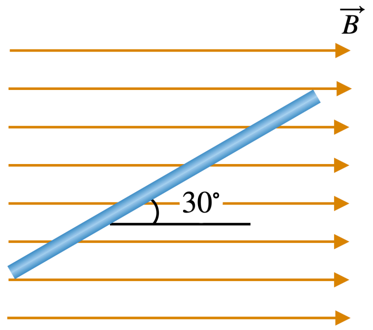
A. 0.25 B. 0.5 C. 1 D. 2

19. The figures below show four different diagrams of a negatively charged particle traveling in circular orbit with velocities and magnetic field directions as indicated. The diagrams that represent the correct orbit are:



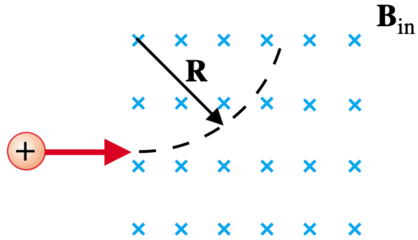
A. diagrams 1 and 2. B. diagrams 3 and 4. C. diagrams 2 and 4. D. diagrams 1 and 3.

20. A 3 m long wire, carrying 15 A current, is placed at an angle of 30° to a uniform 2.5 T magnetic field, as shown in the figure. The magnetic force on the wire in (N) unit is:



A. 56.3 B. 74.1 C. 80.3 D. 112.5

21. A magnetic field $B = 0.4$ T is used to bend a singly ionized ion ($Q = |e|$) into a curved path of radius $R = 0.23$ m. If the ion enters the field with speed $v = 45$ km/s, then the mass of the ion in (kg) unit is:

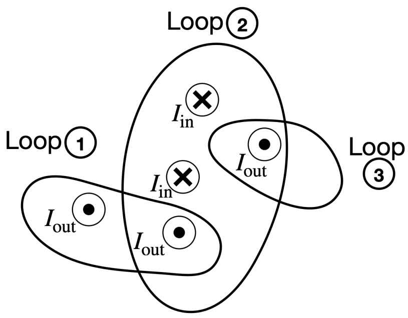


A. 1.8×10^{-28} B. 3.27×10^{-28} C. 1.8×10^{-25} D. 3.27×10^{-25}

22. Two parallel 37-m wires separated by 1.2 cm each carrying a current of 15 A in opposite directions. The magnitude of the magnetic force exerted on each wire in (N) unit is:

A. 0.10 B. 0.14 C. 0.22 D. 0.37

23. The figure shows 5 wires each carrying a current I perpendicular to the page. The magnitude of $\oint \mathbf{B} \cdot d\mathbf{s}$ for the closed loops in the figure can be ranked as:



A. $2 < 1 < 3$ B. $3 < 1 < 2$ C. $2 < 3 < 1$ D. $3 < 2 < 1$

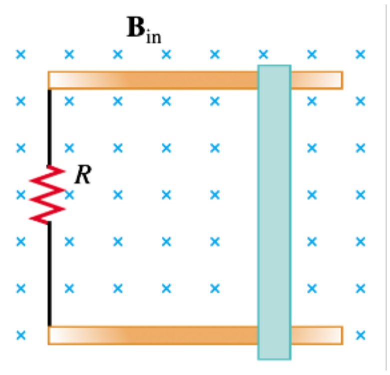
24. The unit of the permeability of free space (μ_0) is equivalent to:

A. $\dfrac{N \cdot m^2}{A}$ B. $\dfrac{N}{A^2}$ C. $\dfrac{N}{A \cdot m}$ D. $\dfrac{N \cdot A}{m}$

25. A coil of area 50 cm^2 has 1000 turns. If a uniform magnetic field directed perpendicular to the plane of the coil is reduced from 0.2 T to zero in 0.2 s, the magnitude of the induced electromotive force (emf) in the coil in (V) unit is:

A. 1 B. 2 C. 5 D. 10

26. A conducting bar of length 6 cm moves on two frictionless conducting parallel rails connected to a resistance ($R = 10\ \Omega$) in the presence of a uniform 2-T magnetic field directed into the page, as shown in the figure. If the bar moves to the right with a constant speed of 150 m/s, then the current in the circuit in (A) unit equals:



A. 1.8 B. 2.4 C. 3.2 D. 4.6

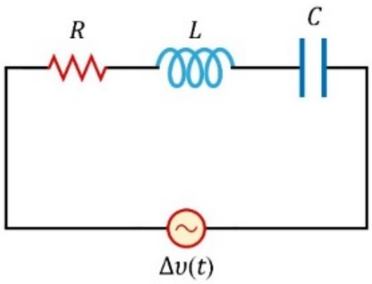
27. A self induced electromotive force (emf) of 50 mV is induced in the windings of a coil when the current in the coil is increasing at a rate of 2.2 A/s. The inductance L of the coil in (mH) unit is:

A. 10.2 B. 22.7 C. 42.3 D. 55.3

28. The energy stored in a 50-mH inductor carrying a current of 4 A in (J) unit is:

A. 0.4 B. 2 C. 50 D. 200

29. As shown in the circuit, a sinusoidal voltage $\Delta v(t) = 100 \sin(1000t)$, where t is in seconds and Δv is in volts, is applied to a series RLC circuit with $R = 400\ \Omega$, $C = 5\ \mu F$, and $L = 0.5$ H. The impedance (Z) of the circuit in (Ω) uint is:



A. 50 B. 100 C. 500 D. 1000

30. In the ***previous question* (Q.29)**, the voltage leads the applied current in the RLC circuit by:

A. 36.9° B. 43.2° C. 64.5° D. 85.3°

31. In the ***previous question* (Q.29)**, the resonance frequency (ω_0) of the circuit in (rad/s) equals:

A. 59.3 B. 264.3 C. 417.5 D. 632.5

32. In a series RLC AC circuit, if the instantaneous voltage and the instantaneous current are given by $\Delta v(t) = 100 \sin(\omega t)$ and $i(t) = 100 \sin(\omega t + \pi/3)$ respectively, where t is in seconds, Δv is in volts, and i is in amperes. Then the average power in (kW) unit is:

A. 1.5 B. 2.5 C. 5.5 D. 10.5

(End of Questions)

Best wishes..