國立高雄大學 107 學年度
第 2 學期理學院

普通物理學基礎能力
會考試題

考試日期：108.6.17(星期一)

考試時間：17：00-19：00

系所：_____ **姓名：**_____ **學號：**_____

規定事項：

1. 請攜帶學生證（或有照片之證件）準時應考，以便身分核對。
2. 應試時請依當日公告之座位表入座。
3. 遲到逾 20 分鐘者，不得入場；已入場應試者，60 分鐘內不得出場。
4. 答案卡應以 2B 鉛筆作答，攜帶軟性品質較佳之橡皮擦備用。
5. 禁止使用電子產品（如：手機）
6. 電子計算器:僅限簡易型電子計算機(限僅有數字鍵 0～9 及＋－×÷√%M 等功能)”

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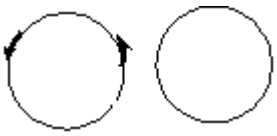
<第一部份-基礎題型 1-15 共 15 題，每題 2 分，共 30 分>

1. A moving electron can be accelerated without changing its speed by

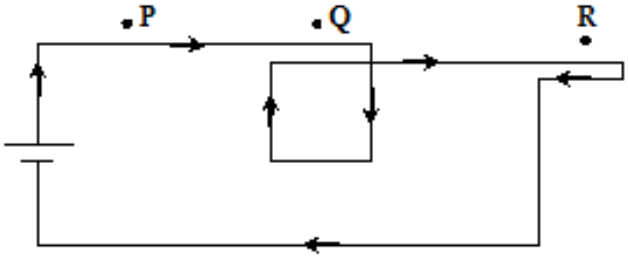
(A) an electric field.
(B) a magnetic field.
(C) magnetic and electric field.
(D) This situation can not be possible.
(E) none of these.

2. Two loops of wires are side-by-side in the plane of the page. Initially no current flows in either loop. The current in the left loop is gradually increased in CCW direction. Which of the following statements is correct?



(A) There is a current induced in the right loop, and it is in CCW direction.
(B) There is a current induced in the right loop, and it is in CW direction.
(C) There is no current induced in the right loop since the magnetic field produced by the current of the
left loop is entirely inside the loop.
(D) There is no magnetic flux through the left loop.
(E) There is no magnetic flux through the right loop.

3. A battery establishes a steady current around the circuit shown. What is the relationship among the magnetic fields at points P,Q, and R?

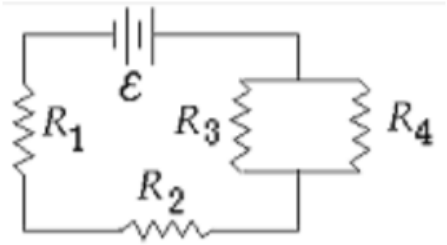


(A) $B_P > B_Q > B_R$
(B) $B_Q > B_P > B_R$
(C) $B_Q > B_R > B_P$
(D) $B_R > B_P > B_Q$
(E) $B_R = B_Q > B_P$

4. A 6V storage battery supplies energy to a simple circuit at the constant rate of 48 W. The resistance of the circuit is

(A) 8 Ω
(B) $\sqrt{8}\Omega$
(C) 3/2 Ω
(D) 4/3 Ω
(E) 3/4 Ω

5. The circuit in the figure contains a cell of emf ε and four resistors connected as shown. Let the currents in these resistances be designated by I1, I2, I3, I4, respectively. Which of the following equations is correct?



(A) $I_1 = I_2$
(B) $I_2 = I_3$
(C) $I_3 = I_4$
(D) $I_1 = I_4$
(E) $I_1 = I_2 + I_3$

6. A 12 H inductor carries a current of 8.0 A. At what rate must the current be changed to produce a 72 V emf in the inductor?

(A) −1.5 A/s
(B) −3.2 A/s
(C) −6.0 A/s
(D) −7.1 A/s
(E) −9.0 A/s

7. The inductance of a closely packed coil of 600 turns is 8.0 mH. Calculate the magnetic flux through the coil when the current is 12.0 mA.

(A) 1.6×10^{-7} Wb
(B) 2.4×10^{-7} Wb
(C) 3.8×10^{-7} Wb
(D) 5.5×10^{-7} Wb
(E) 8.2×10^{-7} Wb

8. A generator supplies 200 V to a transformer's primary coil, which has 100 turns. If the secondary coil has 500 turns, what is the secondary voltage?

(A) 40 V
(B) 250 V
(C) 560 V
(D) 800 V
(E) 1000 V

9. A capacitor with parallel circular plates of radius *R*=1.20 cm is discharging via a current of 12.0 A. Consider a loop of radius *R*/2 that is centered on the central axis between the plates. How much displacement current is encircled by the loop?

(A) 1.5 A (B)3.0 A (C)4.2 A (D)6.0 A (E)7.8 A

10. In a plane radio wave the maximum value of the electric field component is 12.00 V/m. Calculate the maximum value of the magnetic field component.

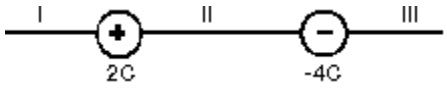
(A) 1.0×10^{-8} T
(B) 2.0×10^{-8} T
(C) 3.0×10^{-8} T
(D) 4.0×10^{-8} T
(E) 5.0×10^{-8} T

11. Two particles, X and Y, are 4 m apart. X has a charge of 2*Q* and Y has a charge of *Q*. The force of X on Y:

(A) has twice the magnitude of the force of Y on X
(B) has half the magnitude of the force of Y on X
(C) has four times the magnitude of the force of Y on X
(D) has one-fourth the magnitude of the force of Y on X
(E) has the same magnitude as the force of Y on X

12. Two point charges are arranged as shown. In which region could a third charge +1 C be placed so that the net electrostatic force on it is zero?

(A) I only
(B) I and II only
(C) III only
(D) I and III only
(E) II only



13. The area vector for a flat surface:

(A) is parallel to the surface and has a magnitude equal to the length of a side of the surface.
(B) is perpendicular to the surface and has a magnitude equal to the length of a side of the surface.
(C) is parallel to the surface and has a magnitude equal to the area of the surface.
(D) is perpendicular to the surface and has a magnitude equal to the area of the surface.
(E) none of the above.

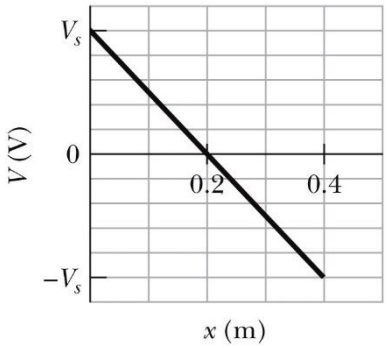
14. An electrically charged object creates an electric field. The electric potential due to this object:

(A) is a vector that points either towards or away from the object, depending on the sign of the charge
(B) is a vector that makes circular paths around the object
(C) is a non-negative scalar

(D) is a scalar but will be positive or negative depending on the sign of the charge

(E) points in the same direction as the field

15. The graph shows the electric potential as a function of *x* in a certain region. What is the *x* component of the electric field in this region if V_s = 50 V?



(A) 250 V/m

(B) 40 V/m

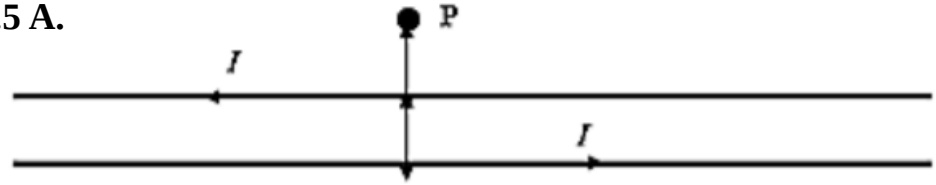
(C) 10 V/m

(D) –40 V/m

(E) –250 V/m

<第二部份-進階題型 16-29 共 14 題，每題 5 分，共 70 分>

16. Calculate the magnetic field and its direction at point P, which is 2.0 cm away from the top wire and 4.0 cm from the bottom wire. Assume both wires are infinitely long and each carries a current of 1.5 A.



(A) 2.3×10^{-5} T directed OUT of the page

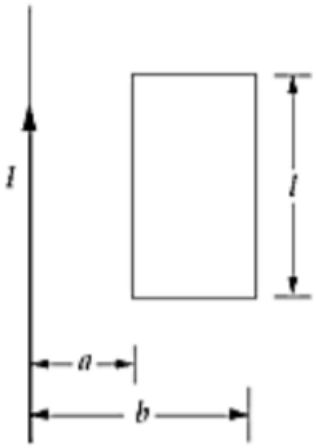
(B) 7.5×10^{-6} T directed INTO the page

(C) 2.3×10^{-5} T directed INTO the page

(D) 2.3×10^{-5} T directed OUT of the page

(E) 1.1×10^{-5}T directed OUT of the page

17. A long straight wire carries a constant current I. The magnitude of the magnetic flux through the illustrated rectangular loop of wire is



(A) $(\mu_0 / 4\pi)2Il \ln(b / a)$

(B) $(\mu_0 / 4\pi)4Il \ln[(a + b) / a)]$

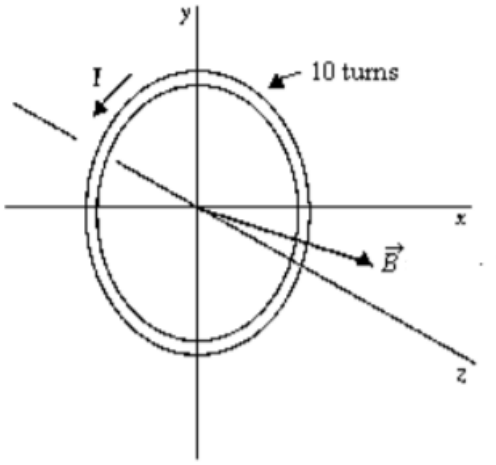
(C) $(\mu_0 / 4\pi)Il \ln[(a + b) / (b - a)]$

(D) $(\mu_0/4\pi)4Il \ln[(b - a)/(b + a)]$

(E) $(\mu_0/4\pi)2Il \ln[(b - a)/(b + a)]$

18. A circular 1-turn coil with a radius of 5.0 cm carries a current of 5.0 A. It lies in the xy plane in a uniform magnetic field $\vec{B} = 0.05\text{T}\hat{i} + 0.12\text{T}\hat{k}$. The potential energy of the system is

(A) –4.7 mJ
(B) –5.1 mJ
(C) –6.3 mJ
(D) 4.7 mJ
(E) 5.1 mJ



19. A coaxial cable consists of a solid inner cylindrical conductor of radius 2.0 mm and an outer cylindrical shell of inner radius 3.0 mm and outer radius 3.5 mm. A current of 15 A flows down the inner wire and an equal return current flows in the outer conductor. If we assume that the currents are uniform over the cross section of the conductors, then calculate the magnitude of the enclosed current for use in Ampere's Law at a radius of 3.25 mm.

(A) 7.2 A
(B) 3.8 A
(C) 7.8 A
(D) 11 A
(E) 7.5 A

20. A circular loop of wire 50 mm in radius carries a current of 80 A. Find the energy density at the center of the loop.

(A) 0.12 J/m^3
(B) 0.36 J/m^3
(C) 0.40 J/m^3
(D) 0.52 J/m^3
(E) 0.86 J/m^3

21. An electric motor has an effective resistance of 61.0 Ω and an inductive reactance of 52.0 Ω when working under load. The rms voltage across the alternating source is 420 V. Calculate the rms current.

(A)1.45 A (B)2.68 A (C)3.15 A (D)5.24 A (E)6.19 A

22. An oscillating *LC* circuit consists of a $75.0\ \text{mH}$ **inductor and a** $3.60\ \mu\text{F}$ **capacitor. If the maximum charge on the capacitor is** $5.00\ \mu\text{C}$**, what is the maximum current?**

(A) 2.19×10^{-3} A

(B) 5.34×10^{-3} A

(C) 6.63×10^{-3} A

(D) 7.12×10^{-3} A

(E) 9.62×10^{-3} A

23.A parallel-plate capacitor with circular plates of radius 0.10 m is being discharged. A circular loop of radius 0.20 m is concentric with the capacitor and halfway between the plates. The displacement current through the loop is 5.0 A. At what rate is the electric field between the plates changing?

(A) 1.2×10^{13} V/m·s

(B) 1.8×10^{13} V/m·s

(C) 2.7×10^{13} V/m·s

(D) 3.3×10^{13} V/m·s

(E) 4.6×10^{13} V/m·s

24. Sunlight just outside Earth's atmosphere has an intensity of $1.40\ \text{kW/m}^2$**. Calculate the electric field amplitude** E_m **for sunlight there, assuming it to be a plane wave.**

(A) 1.03×10^{3} V/m

(B) 2.12×10^{3} V/m

(C) 3.45×10^{3} V/m

(D) 4.22×10^{3} V/m

(E) 5.84×10^{3} V/m

25. Particle 1 with charge q_1, and particle 2, with a charge q_2, are on the x axis, with particle 1 at $x = a$ with and particle 2 at $x = -2a$. For the net force on a third charged particle, at the origin to be zero q_1 and q_2 must be related by q_2=:

(A) $2q_1$

(B) $4q_1$

(C) $-2q_1$

(D) $-4q_1$

(E) $-q_1/4$

26. A uniform electric field of 300 N/C makes an angle of 25° with the dipole moment of an electric dipole. If the torque exerted by the field has a magnitude of 2.5×10^{-7} N·m, the dipole moment must be:

(A) 8.3×10^{-10} C·m

(B) 9.2×10^{-10} C·m

(C) 2.0×10^{-9} C·m

(D) 8.3×10^{-5} C·m

(E) 1.8×10^{-4} C·m

27. Charge *Q* is distributed uniformly throughout an insulating sphere of radius *R*. The magnitude of the electric field at a point *R*/2 from the center is:

(A) $Q/4\pi\varepsilon_0 R^2$

(B) $Q/\pi\varepsilon_0 R^2$

(C) $3Q/4\pi\varepsilon_0 R^2$

(D) $Q/8\pi\varepsilon_0 R^2$

(E) none of these

28. A parallel-plate capacitor has a plate area of 0.2 m^2 and a plate separation of 0.1 mm. To obtain an electric field of 2.0×10^6 V/m between the plates, the magnitude of the charge on each plate should be:

(A) 3.5×10^{-6} C

(B) 7.1×10^{-6} C

(C) 1.4×10^{-5} C

(D) 1.8×10^{-5} C

(E) 8.9×10^{-5} C

29. The diagram shows six 6-μF capacitors. The capacitance between points a and b is:

(A) 1 μF

(B) 3 μF

(C) 4 μF

(D) 6 μF

(E) 9 μF