Semester One of Academic Year (2015—2016) of BJUT

《 University Physics 2》

Module Code: BDIC2008J

Exam Paper A

Exam Instructions: Answer ALL Questions

Honesty Pledge:

I have read and clearly understand the Examination Rules of Beijing University of Technology and University College Dublin and am aware of the Punishment for Violating the Rules of Beijing University of Technology and University College Dublin. I hereby promise to abide by the relevant rules and regulations by not giving or receiving any help during the exam. If caught violating the rules, I would accept the punishment thereof.

Pledger: _____ **Class No:** _____

BJUT Student ID: _____ **UCD Student ID**_____

Notes:

The exam paper has 3 parts on 5 pages, with a full score of 100 points. You are required to use the given Examination Book only.

Instructions for Candidates

Full marks will be awarded for complete answer to **All** questions.

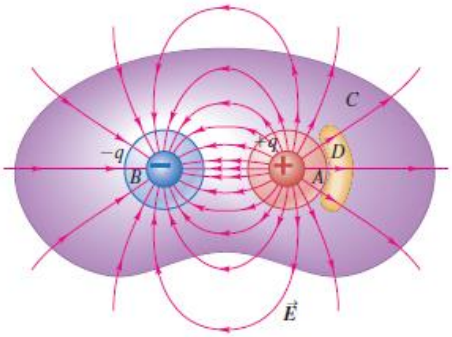
Instructions for Invigilators

Candidates are allowed to use non-programmable calculators during this examination.

Obtained score

Part 1: Multiple Choice (This part consists of 10 questions. Each question is worth 3 points.)

1. As shown in figure,



(A) the electric flux through closed surface A is $\varphi_E = q/\varepsilon_0$.

(B) the electric flux through closed surface B is $\varphi_E = q/\varepsilon_0$.

(C) the electric flux through closed surface C is $\varphi_E = 2q/\varepsilon_0$.

(D) the electric flux through closed surface D is positive.

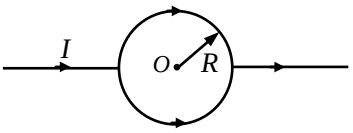
2. There is a uniform electric field $\vec{E} = (400\vec{i} + 600\vec{j})\text{V/m}$. The electric potential difference between point $A(5,\ 2)$ and point $B(6,\ 0)$ is $V_A - V_B =$

(A) –800V (B) +1600V (C) +800V (D) –1600V

3. A straight conductor is split into identical semicircular turns as shown in figure. The magnitude of the magnetic field at the center O of the circular loop is

(A) $\frac{\mu_0 I}{2R}(1+\frac{1}{\pi})$ (B) $\frac{\mu_0 I}{2R}(1-\frac{1}{\pi})$

(C) 0 (D) $\frac{\mu_0 I}{2R}$



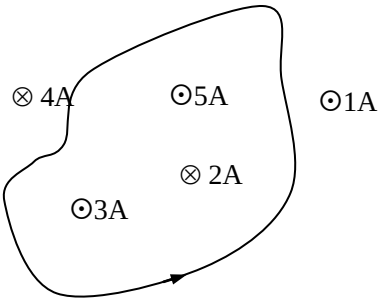
4. What is $\oint \vec{B}\cdot d\vec{l}$ for the path shown in the figure.

（A） $-24\pi\times10^{-7}\text{T}\cdot\text{m}$

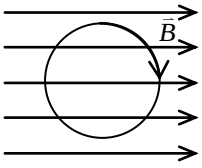
（B） $+24\pi\times10^{-7}\text{T}\cdot\text{m}$

（C） $-40\pi\times10^{-7}\text{T}\cdot\text{m}$

（D） $+40\pi\times10^{-7}\text{T}\cdot\text{m}$



5. The wire loop carries a clockwise current. There is a uniform magnetic field $\vec{B}$ directed to the right. What is the direction of the torque on the current loop?



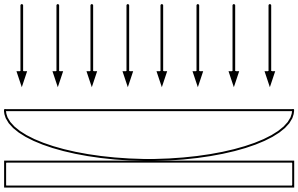
(A) Into the page (B) Out of the page

(C) Up the page (D) Down the page

(E) The net torque is zero.

6. Plane monochromatic light are incident normally on a plane convex lens. When you

lift the plane convex lens lightly the fringes will



(A) translate to the right. (B) translate to the left.
(C) expand outward. (D) contract inward.

7. In the experiment of single-slit diffraction, light of wavelength λ is incident normally on a single $a = 4\lambda$ wide slit. How many half- wavelength -bands is the slit divided corresponding to the direction of angle 30° ?

(A) 2 (B) 4 (C) 6 (D) 8

8. A vertically oriented ideal polarizing sheet transmits 50% of the incident linearly polarized light. The polarizing sheet is now rotated through 45°. What fraction of the incident intensity now passes?

(A)0 (B) 50% (C)100% (D) Either 0 or 100%

9. The experiment which firstly proved that De Broglie′s hypothesis was right is

(A) Rutherford experiment (B) Compton experiment
(C) Stern-Gerlach experimen (D) The Davisson-Germer experiment

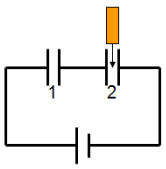
10. The four quantum numbers of a 3*d* electron in hydrogen atom can be

(A) (2, 1, 2, 1/2) (B) (3, 1, 1, −1/2)
(C) (3, 2, 0, 1/2) (D) (1, 0, 1, −1/2)

Obtained score

Part 2: Blank Filling

11. (5 points) Charge the two capacitors connecting in series. Keeping the connection with the electrical source, and then insert a dielectric into capacitor 2. Then the potential difference of capacitor 1 will _____; the charge on capacitor 1 will _____; and the energy storied in capacitor 1 will ___.(increase, not change, decrease)



12. (3 points) The integral form of Maxwell equations is

$$\oint_S \vec{D}\cdot d\vec{S} = \int_V \rho dV \qquad \text{(A)}$$

$$\oint_L \vec{E}\cdot d\vec{l} = -\int_s \frac{\partial \vec{B}}{\partial t}\cdot d\vec{S} \qquad \text{(B)}$$

$$\oint_S \vec{B}\cdot d\vec{S} = 0 \qquad \text{(C)}$$

$$\oint_L \vec{H}\cdot d\vec{l} = \int_s (\vec{\delta} + \frac{\partial \vec{D}}{\partial t})\cdot d\vec{S} \qquad \text{(D)}$$

Determine which equation the following descriptions are related to.

(1) The changing magnetic fields must be accompanied with electric fields.

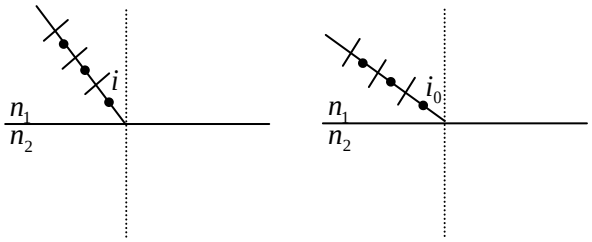
_____

(2)Magnetic field lines never have end points, they always form closed

loops._____

(3)There are electric fields surrounding a charge._____

13. (4 points) An unpolarized light beam is incident on a surface. The incidence angle i_0 is Brewster's angle and $i_0 \neq i$. Please draw the reflected lights and refracted lights in the figure.



14. (5 points) The wave function of a particle is $\psi(x)=\frac{1}{\sqrt{a}}\cos\frac{3\pi x}{2a}$ $(-a \le x \le a)$.

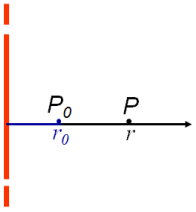
The distribution probability of the particle at point x=5a/6 is_____. At point x=_____ the distribution probability of the particle is maximum.

15. (3 points) Atoms can emit photons by spontaneous emission and stimulated Emission. Two photons produced by spontaneous emission_____ coherent, but two photons produced by stimulated emission_____ coherent.(are/are not)

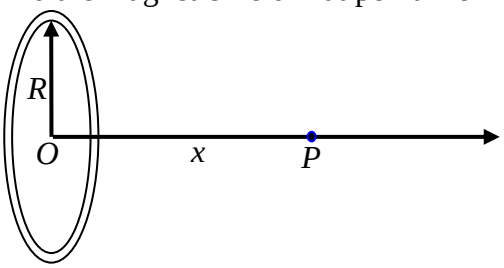
Obtained score

Part3: Calculation (Each question is worth 10 points.)

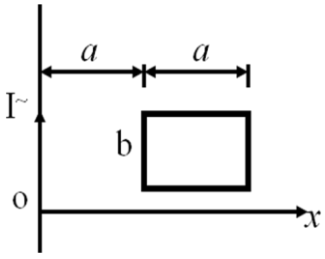
16. Find the potential at a distance r from a very long line of charge with linear charge density λ. Set $V_{P_0}=0$.



17. Consider a coil with radius R and current I. Find the magnetic field B at point P on the axis of the coil. The distance between points O and P is x.



18. Rectangular loop is coplanar with the infinite long current wire. If the current is $I=I_0\cos wt$, what is the electromotive force ε_i in the loop?



19. Lenses are often coated with thin film of transparent

substance such as MgF_2 to reduce the reflection from the glass surface. How thick a coating is needed at least to produce a minimum reflection at the center of the visible spectrum (λ=550nm)

20. Plane monochromatic waves with wavelength λ=600nm are incident normally on a plane transmission grating. The diffraction angle of the second principal maximum is 30°， and the third principal maximum is missing order.

(1) What is the grating constant a+b？

(2) What is the minimum value of a？

(3) How many bright fringes can we observe?