Beijing-Dublin International College

SEMESTER I FINAL EXAMINATION - 2016/2017

Beijing-Dublin International College

《UNIVERSITY PHYSICS 2》 BDIC2008J

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Time Allowed: 95 minutes

Instructions for Candidates

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

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

I have read and clearly understand the Examination Rules of both Beijing University of Technology and University College Dublin. I am aware of the Punishment for Violating the Rules of Beijing University of Technology and/or 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 accept the punishment thereof.

Honesty Pledge： _____ **(Signature)**

Instructions for Invigilators

Non-programmable calculators are permitted.
No rough-work paper is to be provided for candidates.

Obtained score

Part 1: Multiple Choice (2 marks each question, 30 marks altogether)

1. An imaginary, closed, spherical surface S of radius R is centered on the origin. A positive charge $+q$ is originally at the origin. And the flux through the surface is Φ_E. Three additional charges are now added along the x axis: $-3q$ at $x=-R/2$, $+5q$ at $x=R/2$, and $+4q$ at $x=-3R/2$. The flux through S is now

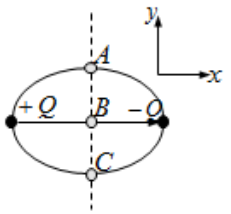
(A) $2\Phi_E$

(B) $3\Phi_E$

(C) $6\Phi_E$

(D) Φ_E cannot be determined, because the problem is no longer symmetric.

2. The dotted line represents the *y*-*z*-plane located halfway between two points with charge $+Q$ and $-Q$ respectively. Which statement properly describes the relationship between the potentials at points *A*, *B*, and *C*?



(A) $V(A)=V(B)=V(C)$

(B) $V(A)=V(B)>V(C)$

(C) $V(A)=V(B)<V(C)$

(D) $V(C)<V(B)<V(A)$

(E) $V(C)>V(B)>V(A)$

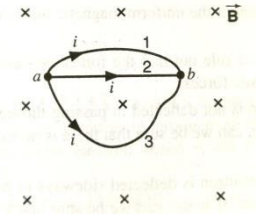
3. It requires 1mJ of work to move two identical positive charges +*q* from infinity so that they are separated by a distance *a*. How much work is required to move three identical positive charges +*q* from infinity so that they are arranged at the vertices of an equilateral triangle with edge length *a*?

(A) 2mJ (B) 3mJ (C) 4mJ (D) 9mJ

4. Consider a solenoid with $R \ll L$. The magnetic field at the centre of the solenoid is B_0. A second solenoid is constructed that has twice the radius, twice the length, and carries twice the current as the original solenoid, but has the same number of turns per meter. The magnetic field at the center of the second solenoid is

(A) $B_0/2$ (B) B_0 (C) $2B_0$ (D) $4B_0$

5. There are several wire segments that carry equal currents from a to b. The wires are in a uniform magnetic field directed into the page. Which wire segment experiences the largest net force?



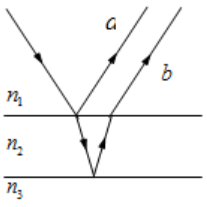
(A) 1

(B) 2

(C) 3

(D) All experience the same net force.

6.A ray of light is incident on a thin film. Two of the reflected rays are shown. Assume that rays *a* and *b* undergo a phase change because of differences in the indices of refraction. Which would be the proper ordering of the indices?



(A)$n_1>n_2>n_3$

(B)$n_2>n_3>n_1$

(C)$n_3>n_2>n_1$

(D)None of these; the specified phase changes cannot occur.

7. Two ideal polarizing sheets are stacked so that none of the incident unpolarized light is transmitted. A third polarizing sheet is slipped between the first two sheets at an angle of 45 ºto the bottom sheet. The fraction of light transmitted through the entire stack is

(A) still zero (B)1/8 (C)1/4 (D)1/2

8. Monochromatic light with a frequency well above the cutoff frequency is incident on the emitter in a photoelectric-effect apparatus. The frequency of the light is then doubled while the intensity is kept constant.How does this affect the stopping potential?

(A)The stopping potential will increase.

(B)The stopping potential will decrease.

(C)The stopping potential will remain the same.

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

(A) Rutherford experiment (B) Compton experiment

(C) Stern-Gerlach experimen (D) The Davisson-Germer experiment

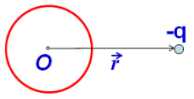
10. An atom in the ground state has 17 electrons. Assuming that all of the inner shells are completely filled, what is the number of electrons in the outermost shell?

(A) 2 (B) 5 (C) 7 (D) 8

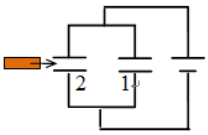
Obtained score

Part2: Blank Filling (5 marks each question, 20 marks altogether)

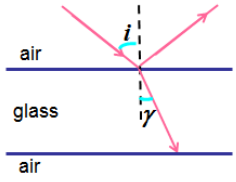
1. There is no charge on the conductor spherical surface. The vector from the spherical centre to point charge $-q$ is $\vec{r}$. The induced charge on the conductor spherical surface is _____; The electric field at point O produced by the induced charge is _____.



2. Charge the two capacitors connecting in parallel and cut off the power cord, 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)



3. The two surfaces are parallel to each other. The incident light is unpolarized light. If the reflected light from the upper surface is totally polarized, the incident angle i=_____. The refraction angle γ=_____. The reflected light from the lower surface _____ (is/is not) linearly polarized light. (n_{glass}=1.60)

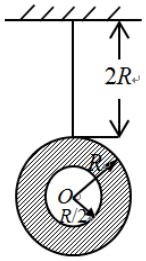


4. The wave function of a particle is $\psi(x)=\frac{1}{\sqrt{a}}\cos\frac{3\pi x}{2a}$ $(-a\le x\le a)$. The distribution probability of the particle at point x=5a/6 is_____. At point x=_____ the distribution probability of the particle is maximum.

Obtained score

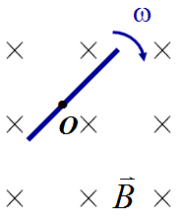
Part 3: Calculation(10 marks each question, 50 marks altogether)

1. Electric charge Q is distributed uniformly throughout an annulus of inner radius R/2 and outer radius R. Another Q is distributed uniformly on a 2R length rope. The annulus is hung up by this rope, and the annulus centre O is on the extension line of the rope, as shown in figure. Find the electric field of point O.



2. A metal sphere of radius a has a charge Q and is surrounded by an isotropical dielectric (relative permittivity ε_r) up to a radius b . What is the potential at the centre of the sphere? (Let $V(\infty)=0$)

3. A conducting bar with length L rotating at an angular speed ω in a magnetic field.The axis is parallel to magnetic field and perpendicular to the bar, as shown in figure. If the point at L/3 is revolution axis, find the motional emf between the two ends.



4.A common lens coating material is magnesium fluoride MgF_2 with $n = 1.38$. What thickness should a nonreflective coating have at least for 550-nm light if it is applied to glass with $n = 1.52$?

5. The wavelengths of the visible spectrum are approximately 380 nm (violet) to 750 nm (red). (a) Find the angular limits (the angles spanned by the visible spectrum) of the first-order visible spectrum produced by a plane grating with 600 slits per millimeter when white light falls normally on the grating. (b) Which orders of spectra will overlap?