Assiut University Faculty of Science Department of Physics	Final exam: fall 2018 - 2019 Date: Dec. 26, 2018 Time: 2 hours
Course Title: General Physics 2 (Code: 105 P)	**Exam in 3 pages**

Constants: $\varepsilon_0=8.85\times10^{-12}\ C^2/N\,m^2$; $k_e=9\times10^9\ Nm^2/C^2$; $e=1.6\times10^{-19}\ C$

Answer all of the following questions

First question: Choose the correct Answer **(15 marks)**

Answer only Ten of the following:

1) Field lines start on positive charges and end on negative charges.

a) True **b) False**

2) Law stating that "force is directly proportional to product of charges and inversely proportional to square of separation between them" is called

a) Newton's law **b) Coulomb's law** **c) Gauss's law**

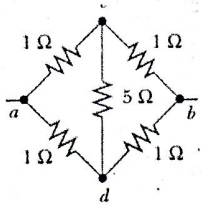
3) The net electric flux through any closed surface is equal to the net charge inside it divided by ε_0:

a) True **b) False**

4) When a particle of charge q and mass m is placed in an electric field E, the electric force exerted on the charge

a) $\vec{F}=\vec{E}/q$ **b)** $\vec{F}=q\vec{E}$ **c)** $\vec{F}=q/\vec{E}$

5) Consider five resistors connected as shown in the figure below. Find the equivalent resistance between points a and b



a) 4 Ω **b) 7 Ω** **c) 1 Ω**

6) The equivalent resistance of a series combination of resistors is ..... than any of the individual resistors

a) larger **b) less** **c) all of previous**

7) A spherical balloon contains a positive charge at its center. The balloon is inflated to a greater volume while the charge remains at the center. The magnitude of the electric field at the surface of the balloon:

a) increases **b) decreases** **c) remains the same**

8) In order to maximize the percentage of the power that is delivered from a battery to a device, the internal resistance should be

a) as low as possible **b) as high as possible** **c) the percentage does not depend on internal resistance**

9) Figure 1 represents the current-voltage relation for

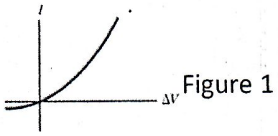


Figure 1

a) Ohmic materials **b) Nonohmic materials**

Look at the back page

10) When a dielectric material is inserted between the plates of a capacitor, its capacitance

a) **increases** b) **decreases** c) **remains the same**

11) Many computer keyboard buttons are constructed of capacitors. When a key is pressed, the capacitance

a) **increases** b) **decreases**

12) A thin spherical shell of radius **a** has a total charge "2Q" distributed uniformly over its surface. The electric field at points inside the shell is

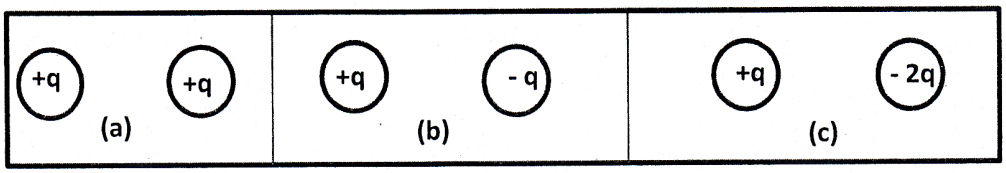
a) $2kQ/a^2$ b) **Zero** c) kQ/a^2

13) Resistance of a wire is directly proportional to its

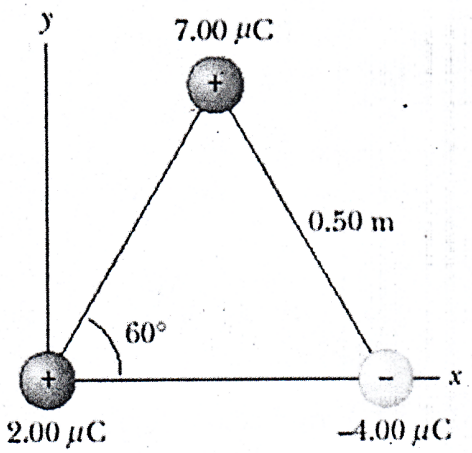
a) **Area of cross section** b) **Length**

Second question: Answer all of the following (8 marks)

1) Draw the electric filed lines for the following configurations of charges



2) Three point charges are located at the corners of an equilateral triangle as shown in the figure below. Calculate the resultant electric force on the $7.00\ \mu C$ charge.

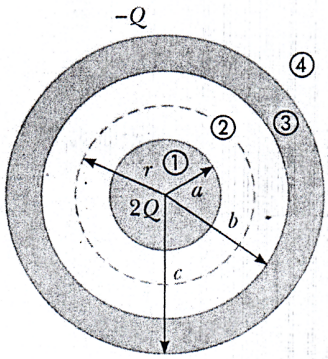


Third question: answer all of the following (8 marks)

1) A **12 V** battery is connected between two parallel plates. The separation between the plates is **d= 0.3 cm**. Find the magnitude of the electric field between the plates (assuming that **E** is uniform) .

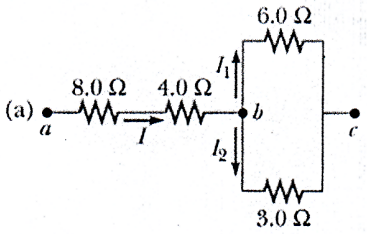
Look at the back page

2) A solid conducting sphere of radius ***a*** has a net charge ***+2Q***. A conducting spherical shell of inner radius ***b*** and outer radius **c** is concentric with the solid sphere and has a net charge ***–Q***. Using Gauss Law find the electric field in the regions labeled **1, 2,** and 4



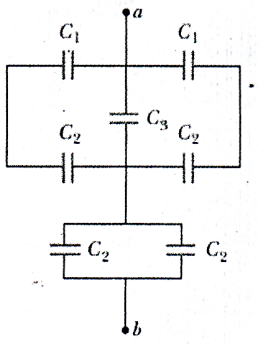
Fourth question: answer all of the following (10 marks)

1) Find the equivalent resistance between points a and b?



2) Find the capacitance of a parallel-plate capacitor that has an area **A=2 x 10 $^{-4}$ m^2** and a plate separations **d =1mm**

3) Find the equivalent capacitance between points a and b for the group of capacitors connected as shown in the figure. Take **C_1 = 5 μF, C_2 = 10 μF, C_3 = 2 μF**

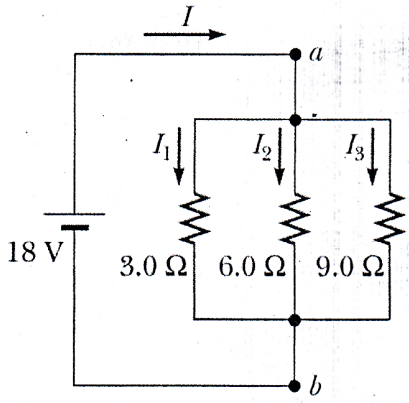


Fifth question: answer all of the following (9 marks)

1) A resistance thermometer, which measures temperature by measuring the change in resistance of a conductor, is made from platinum and has a resistance of **50 Ω** at **20 °C**. When immersed in a vessel containing melting indium, its resistance increases to **76.8 Ω**, calculate the melting point (temperature) of indium? (For **Platinum α= 3.9x10^{-3} C^{-1}**)

2) Three resistors are connected in parallel as shown. A potential difference of 18V is maintained between points a and b.

   a) Find the current in each resistor?
   b) Calculate the power delivered to each resistor.



End of questions---------- Best wishes

Dr. Mansour Abdel Sattar

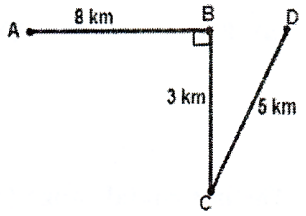
Assiut University **Faculty of Science** **Department of Physics**	**First semester 2018-2019** **Date: 26/12/2018**	**Final Exam (Grade 50/100)** **General Physics I (P100)** **Exam Duration: 2 hours**

Part I: Circle the correct answer for the following statements: **(12 Marks)**

1. The average kinetic energy E of a gas molecule is given by the equation $E = (3/2)\,kT$, where T is the absolute temperature in K, what are the SI units of k?
   a) $kg^{-1}.m^{-1}.s^{2}.K$ b) $kg^{-1}.m^{-2}.s^{2}.K$ c) $kg.m.s^{-2}.K^{-1}$ d) $kg.m^{2}.s^{-2}.K^{-1}$

2. The work done by the centripetal force is always
   a) positive. b) negative. c) zero. d) not determined.

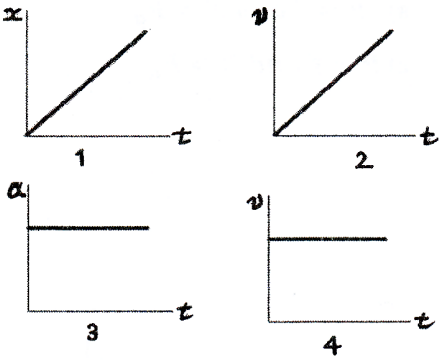
3. A car takes 15 minutes to travel along the shown path ABCD. The average speed of the car is: (A, B and D are on a straight line)
   a) 48 km/h b) 22 km/h c) 64 km/h d) 4 km/h



4. In the previous problem the average velocity of the car (to right) is:
   a) 48 km/h b) 22 km/h b) 64 km/h d) 4 km/h

5. Two bodies of different materials having the same volume fall freely together from the same height. Neglecting air resistance, which statements describes correctly their arrival to the ground?
   a) The heavier body reaches first. b) The lighter body reaches first.
   c) The heavier body accelerates more. d) The two bodies reach at the same time.

6. Consider the following four graphs (note the axes carefully), Which of these represents motion at constant speed:
   a) 4 only b) 3 & 4 c) 1 & 2 d) 1 & 4



7. An object has completed two revolutions in a circle of radius 14 cm, its displacement equal to:
   a) zero b) 28 cm c) 88 cm d) 140 cm

8. A person is standing in an elevator which is moving down with a uniform acceleration. The person's apparent weight will be:

   a) same as the weight on the earth surface.

   b) less than the weight on the earth surface.

   c) twice the weight on the earth surface.

   d) greater than the weight on the earth surface.

9. A 6-kg block is released from rest 80 m above the ground, when it fallen 60 m, its kinetic energy is about:

   a) 4800J b) 3528 J c) 1200 J d) 60J

10. A force $\vec{F} = (8x\,\hat{\imath} + 6y\,\hat{\jmath} + 7z\,\hat{k})N$ acts on an object. As the object moves in the x-direction from $x = 1$ m to $x = 3$ m, the work done on the object by the force is:

    a) 8 J b) 32 J c) -32 J d) -8 J

11. The horizontal range (R) of a projectile is 2.5 times the greatest height (h), the initial angle of the projectile is:

    a) 55° b) 56° c) 58° d) 60°

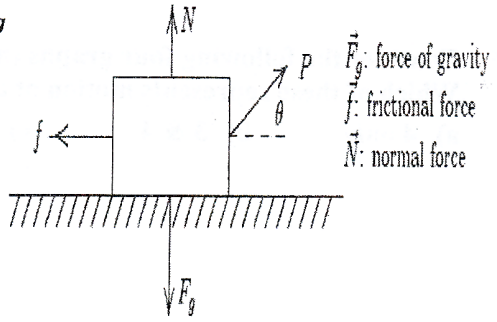
12. A boy pulls a box along a rough horizontal floor at constant speed by a force $\vec{P}$ as shown, which of the following must be true?

    a) $P = f$ and $N = F_g$

    b) $P = f$ and $N < F_g$

    c) $P = f$ and $N > F_g$

    d) $P > f$ and $N < F_g$



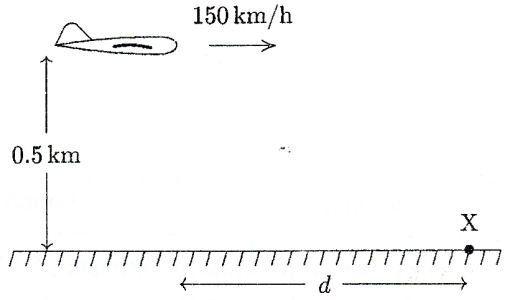
Part II: (20 Marks)

Solve *only four* of the following problems then circle the correct answer:

1. An object is thrown vertically to reach a height h. If the object upward velocity is 18 m/s at a height $h/4$. What is the initial speed of the object?

A. 35 m/s	**B. 25 m/s**	**C. 21 m/s**	**D. 30 m/s**

2. The airplane shown is in level flight at an altitude of 500 m and a speed of 42 m/s. At what distance d should it release a heavy bomb to hit the target X? Take $g = 10$ m/s^2.



A. 150 m	**B. 420 m**	**C. 295 m**	**D. 2550 m**

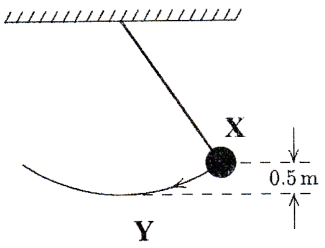
3. An 8.0-kg object rests on the floor of an elevator which is accelerating downward at a rate of 1.3 m/s^2. What is the magnitude of the normal force (n) exerted by the floor of the elevator on the object?

A. 59 N	B. 10 N	C. 89 N	D. 68 N

4. A car weighs 8000 N is traveling at 12 m/s along a horizontal road when the brakes are applied. After the car stops, how much kinetic energy does it lose?

A. 48000 J	B. 59000 J	C. 120000 J	D. 580000 J

5. A simple long pendulum consists of a ball attached to a string. The ball is shifted to point X, 0.5 m above the level of Y point as shown, then it has given an initial speed of 3.0 m/s (to left and perpendicular to the string). What is the speed at the lowest point Y?



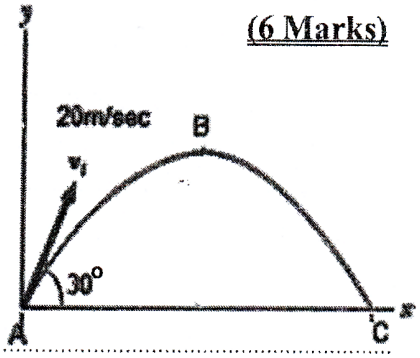
A. 4.3 m/s	B. 0.89 m/s	C. 3.7 m/s	D. zero

Part III: Solve in details the following three problems: (18 Marks)

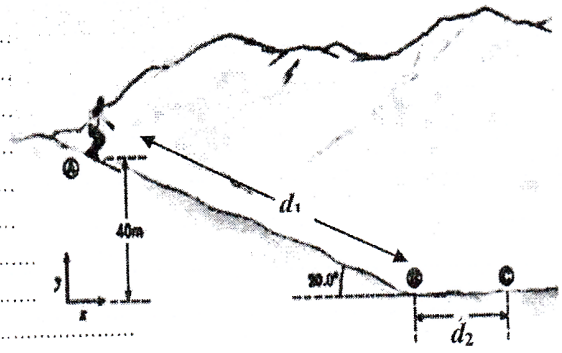
1. Use the dimensional analysis to verify the following law: $F = \frac{mv^2}{r}$, where F is a centripetal force, v is a rotating particle's velocity, m is its mass and r is the orbital radius. (5 Marks)

2. An object is projected upwards with an initial velocity 20 m/s directed at an angle 30° with the horizontal, as shown in figure, find:

a- The vertical component of the object velocity at points A and B,
b- The flight time,
c- Maximum height reached by the object,
d- the distance AC. (6 Marks)



3. A skier starts from rest at the top an incline of height 40 m and makes angle 20° with the horizontal as shown in the figure. At the bottom of the incline, the skier encounters a horizontal surface. The coefficient of the kinetic friction between the skier and snow in both the incline and horizontal is 0.21; How far does the skier travel on the horizontal surface before coming to rest? (7 Marks)



Best regards,

Teaching Staff: *Dr. Susan Abdel-Wahab, Dr. Ahmed Tamer, Dr. Samer Mostafa, Dr. Mohamed Abdelkareem*

جامعة أسيوط
كلية العلوم

امتحان نهاية الفصل – تاريخ العلوم (١٢م.ج)
الفصل الدراسي الأول ٢٠١٨/٢٠١٩

المجموعة الثانية
الزمن: ساعتان

أجب على السؤال الأول بالإضافة إلى سؤالين آخرين فقط من الأسئلة الآتية:

(مجموع درجات الامتحان ٥٠ درجة، وأسئلة الامتحان في صفحتين)

السؤال الأول: اختر الإجابة الصحيحة من الإجابات المعطاة بين القوسين في ما يأتي: (٢٠ درجة)

١) أول من وضع مفهوم السلسلة الغذائية هو العالم (المصري مصطفى السيد – الإنجليزي تشارلز دارون – العربي أبو عثمان بن بحر، الشهير بالجاحظ).

٢) يعتبر الانتقال من الهندسة الإقليدية إلى الهندسة اللاإقليدية نموذجا للتطور (الثوري – التدريجي – المختلط) للعلم.

٣) من الحضارات القديمة التي ساد فيها إعلاء قيمة العقل فوق الغاية النفعية للعلم (الحضارة البابلية – الحضارة الصينية – الحضارة الإغريقية).

٤) من أهم كتب الخوارزمي (طبيعة الرابطة الكيميائية – اللولب المزدوج – كتاب الجبر والمقابلة).

٥) تفوق الإغريق في الهندسة بينما تفوق العرب في (الميكانيكا – الجبر – حساب المثلثات).

٦) من الأمور التي جعلت العلماء لا يقدرون أهمية الحمض النووي DNA كحامل للمعلومات الوراثية (قاعدة شارجاف – فرض رباعي النيوكليوتيدة – تحول البكتريا في تجارب جريفيث).

٧) كان اعتقاد علماء وفلاسفة الإغريق بأن الكون كله مكون من ذرات هو الأساس الذي بنيت عليه نظرية (شمولية التكوين pangenesis – التشكل المتعاقب epigenesis – التخلق السبقي preformation).

٨) من المشاكل التي واجهت الفيزياء الكلاسيكية أنها لم تستطع شرح (إشعاع الجسم الأسود – التأثير الكهروضوئي – تكون قوس قزح بعد سقوط المطر).

٩) كان الحل الذي اقترحه العالم الألماني ماكس بلانك عام ١٩٠٠ لتجنب كارثة الفوق بنفسجي ultraviolet catastrophe (متوافقا مع المفاهيم الفيزيائية السائدة – غير مبني على إي دليل تجريبي – مقنعا لجميع الفيزيائيين في عصره).

١٠) أول من قدم الأسباب العلمية الدالة على كروية الأرض هو (الخوارزمي – فيثاغورث – أرسطو)

١١) اهتم المصريون القدماء (بالتطبيق العملي للعلوم – بالبحث في أسرار المادة – بصياغة فلسفة العلم).

١٢) كان نيوتن مقتنعا بأن الضوء يتكون من (جسيمات – موجات – خليط من الجسيمات والموجات).

١٣) حقق العالم الأمريكي ملفن كالفن إنجازه التاريخي في اكتشاف تفاعلات البناء الضوئي خطوة بخطوة (باستخدام كيمياء الفمتو التي طورها أحمد زويل – قبل تطوير كيمياء الفمتو – باستخدام كيمياء الفمتو مع طرق أخرى).

بقية الأسئلة في الصفحة التالية >>>

<<< تكملة الأسئلة الموجودة بالصفحة السابقة

١٤) استطاع الإغريق إجراء عمليات الجمع والطرح، والضرب والقسمة، وإيجاد الجذور التربيعية، باستخدام (آلة حاسبة بدائية الصنع – أصابع اليدين – المسطرة والفرجار).

١٥) يعتبر العلماء تخليق جزيء الحمض النووي المطعم recombinant DNA (قمة الإنجازات المهمة – ثاني أهم إنجاز – الإنجاز المهم الوحيد) في البيولوجيا خلال القرن العشرين.

١٦) تم استنساخ جنين الإنسان عام ١٩٩٣ على يد عالمين أمريكيين بطريقة (التوأمة الصناعية – نقل النواة من خلية جنينية إلى زيجوت – نقل النواة من خلية ناضجة إلى زيجوت).

١٧) عندما قام العالم الألماني فيلهيلم روكس سنة ١٨٨٨ بقتل إحدى الفلجتين في جنين الضفدعة باستخدام إبرة ساخنة، كانت النتيجة تطور الجنين إلى (نصف ضفدعة – ضفدعة كاملة – ضفدعتين كل منهما نسخة من الأخرى).

١٨) من أبرز إنجازات العالم الفرنسي أنطوان لافوازييه (اكتشاف الأكسجين على أسس كيميائية صحيحة – صياغة نظرية الفلوجستون – اكتشاف البلاستيدات الخضراء).

١٩) شهد القرن (الأول الميلادي – الخامس الميلادي – التاسع الميلادي) ذروة تقدم العلوم العربية والإسلامية.

٢٠) أول من اكتشف الأحماض النووية في الخلية هو العالم (الأمريكي أوزوالد أفري – الألماني ألبريخت كوسل – السويسري فريدريش ميشر).

السؤال الثاني: (١٥ درجة)

أ) من دراستك لتاريخ العلوم، اذكر اسم عالم ترى أنه يمكن أن يكون مثلا أعلى لك، واكتب عن إنجازاته باختصار.

ب) كان واتسون وكريك يريدان اكتشاف تركيب الحمض النووي بدون إجراء تجارب معملية، فما الذي شجعهما على ذلك؟

جـ) اشرح خصائص العلم.

السؤال الثالث: (١٥ درجة)

أ) قارن بين خصائص الفيزياء الكلاسيكية classical physics وفيزياء الكم quantum physics.

ب) كانت ولادة أول طفل أنابيب عام ١٩٧٨ إنجازا علميا أكثر من كونها مجرد ممارسة طبية هدفها حل مشاكل الإنجاب. اشرح ذلك.

جـ) ناقش كيف يتطور العلم، بدون ذكر أمثلة.

السؤال الرابع: (١٥ درجة)

أ) اشرح المقصود بالمنهج الاستقرائي، والمنهج الاستنباطي، مع ذكر أنواع العلوم المرتبطة بكل منهما.

ب) اكتب نبذة مختصرة عن تطور الأعداد منذ نشأتها وصولا إلى اختراع الأرقام العربية.

جـ) من هو العالم الذي يعتبر تاريخيا مكتشف البناء الضوئي؟ اكتب نبذة مختصرة عن أشهر تجاربه.

انتهت الأسئلة ـــــــــــــــ مع تمنياتي بالتوفيق

Assiut University

Faculty of Science

Date: 4/9/2018
Time: 2 hours

Final Exam: General Physics II
Code:105P

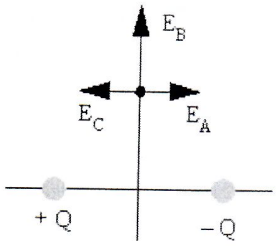
Physics Department

Answer ONLY FOUR question of the followings

Note: Given choices may be approximated

First Question (Choose the most accurate answer) (12.5 Marks)

1. **Which of the following best characterizes electrical conductors?**
   a. low mass density
   b. high tensile strength
   c. electric charges move freely
   d. poor heat conductors
2. **Under which conditions, an attraction electric force occurs between two charged objects?**
   a. Charges are of unlike signs.
   b. Charges are of like signs.
   c. Charges are of equal magnitude.
   d. Charges are of unequal magnitude.
3. **A metallic object holds a charge of -3.8×10^{-6} C. What a total number of electrons does this represent? ($e = 1.6 \times 10^{-19}$ C is the magnitude of the electronic charge.)**
   a. 4.2×10^{14}
   b. 6.1×10^{13}
   c. 2.4×10^{13}
   d. 1.6×10^{14}
4. **Two point charges are 4 cm apart. They are moved to a new separation of 2 cm. By what factor does the resulting mutual force between them change (final/initial ratio)?**
   a. 1/2
   b. 2
   c. 1/4
   d. 4
5. **An electron with a charge value of 1.6×10^{-19} C is moving in the presence of an electric field of 400 N/C. What is the magnitude of the force the electron experiencing?**
   a. 2.3×10^{-22} N
   b. 1.9×10^{-21} N
   c. 6.4×10^{-17} N
   d. 4.9×10^{-17} N
6. **Two charges, +Q and -Q, are located two meters apart and there is a point along the line that is equidistant from the two charges as indicated. Which vector best represents the direction of the electric field at that point?**



   a. Vector E_A
   b. Vector E_B
   c. Vector E_C
   d. The electric field at that point is zero.
7. **Charge "A" has 10 electric field lines coming out, Charge "B" has 20 lines coming out, and Charge "C" has 30 lines coming in. Which pair of these charges will have the largest attraction force between them if placed one cm apart?**
   a. A and B
   b. B and C
   c. C and A

d. More information is needed.

8. **The unit of electrical potential, the volt, is dimensionally equivalent to:**
   a. J·C.
   b. J/C.
   c. C/J.
   d. F·C.
9. **The unit of capacitance, the farad, is dimensionally equivalent to which of the following?**
   a. V/C
   b. V·C
   c. J/V
   d. C/V
10. **Which is a unit of power?**
    a. kWh
    b. W/s
    c. A·Ω
    d. J/s

Second Question **(12.5 Marks)**

Part I (Choose from "Coulomb B" what is suitable for "Coulomb A") **(8.75 Marks)**

(Choices in "Coulomb B" may be duplicated or may not be used)

Coulomb A	Coulomb B
1. The Electric field due to a point charge q at a distance r	**a.** $E = 0$
2. The Electric field outside a spherically symmetric charge distribution q, with radius R, at a distance r from the center	**b.** $E = \infty$
3. The electric field inside a spherically symmetric charge distribution with radius R, at a distance r from the center	**c.** $E = unknown$
4. The Electric field outside a thin spherical shell carries a charge q, with radius R, at a distance r from the center	**d.** $E = k\frac{q}{r^2}$
5. The Electric field inside a thin spherical shell carries a charge q, with radius R, at a distance r from the center	**e.** $E = k\frac{qR}{r^3}$
6. The Electric field at a distant r, from a thin wire, carries a charge q	**f.** $E = k\frac{qr}{R^3}$
7. The Electric field due to a surface, carries a charge q, at a distant r	**g.** $E = \frac{\sigma}{2\varepsilon_0}, where\ \sigma\ is\ the\ surface\ charge\ density$
	h. $E = k\frac{\sigma}{2r}, where\ \sigma\ is\ the\ surface\ charge\ density$
	i. $E = k\frac{2\lambda}{r}, where\ \lambda\ is\ the\ linear\ charge\ density$
	j. $E = k\frac{\lambda}{r^2}, where\ \lambda\ is\ the\ linear\ charge\ density$
	k. $E = k\frac{2\lambda}{r^2}, where\ \lambda\ is\ the\ linear\ charge\ density$

Part II (Choose the most accurate answer) **(3.75 Marks)**

1. **An initially uncharged hollow metallic sphere with a radius of 5 cm has a small object with a charge of +10 μC placed at the center of the sphere gap. What is the charge presented on the outside surface of the sphere?**
   a. zero
   b. -10 μC
   c. +4000 μC
   d. +10 μC
2. **A charge, +Q, is placed inside a balloon and the balloon is inflated. As the radius of the balloon r increases the number of field lines going through the surface of the balloon:**
   a. increases proportionally to r^2.
   b. increases proportionally to r.
   c. stays the same.
   d. decreases as $1/r$.
3. **A closed surface contains the following point charges: 6 C, 4 C, –2 C, –4 C. The electric flux coming out of the surface is:**
   a. 16 /ε_o.
   b. –16 /ε_o.
   c. 4 /ε_o.
   d. –4 /ε_o.

Third Question (Choose the most accurate answer) **(12.5 Marks)**

1. **A proton (+1.6 × 10^{-19} C) moves 10 cm on a path in the direction of a uniform electric field of strength 3 N/C. How much work is done on the proton by the electrical field?**
   a. 4.8 × 10^{-20} J
   b. -4.8 × 10^{-20} J
   c. 1.6 × 10^{-20} J
   d. zero
2. **A 9 V battery is connected between two parallel metal plates 4 mm apart. What is the magnitude of the electric field between the plates?**
   a. 2.25 × 10^3 N/C
   b. 9 N/C
   c. 2.25 N/C
   d. 0.75 × 10^{-6} N/C
3. **A uniform electric field, with a magnitude of 600 N/C, is directed parallel to the positive *x-axis*. If the potential at x = 3 m is 1000 V, what is the potential at x = 1 m?**
   a. 400 V
   b. 1600 V
   c. 2200 V
   d. 2500 V
4. **A uniform electric field, with a magnitude of 600 N/C, is directed parallel to the positive *x-axis*. If the potential at x = 3 m is 1000 V, what is the change in potential energy of a proton as it moves from x = 3 m to x = 1 m? (q_p = 1.6 × 10^{-19} C)**
   a. 8 × 10^{-17} J
   b. 1.92 × 10^{-16} J
   c. 0.8 × 10^{-21} J
   d. 500 J
5. **What is the ratio of the final potential energy with respect to the initial potential energy (P.E $_{final}$ / P.E $_{initial}$), if the distance between two charges is increased by a factor of three (d_{final} =3 $d_{initial}$)?**
   a. 3
   b. 9
   c. 1/3
   d. 1/9
6. **Find the electrical potential at 0.15 m from a point charge of 6 µC. (k_e = 9 × 10^9 N·m^2/C^2)**
   a. 5.4 × 10^4 V

b. 3.6×10^5 V
c. 2.4×10^6 V
d. 1.2×10^7 V

7. **A point charge of +3 μC is located at the origin and a second point charge of –6 μC is at $x = 1$ m. What is the electric potential at the $x = 0.5$ m point? ($k_e = 9 \times 10^9$ N·m²/C²)**
a. 16×10^4 V
b. 11×10^4 V
c. -11×10^4 V
d. -5.4×10^4 V

8. **Increasing the voltage across the two plates of a capacitor will produce what effect on the capacitor?**
a. increase charge
b. decrease charge
c. increase capacitance
d. decrease capacitance

9. **Increasing the separation of the two charged parallel plates of a capacitor, which are disconnected from a battery, will produce what effect on the capacitor?**
a. increase charge
b. decrease charge
c. increase capacitance
d. decrease capacitance

10. **If three 4 μF capacitors are connected in parallel, what is the combined capacitance?**
a. 12 μF
b. 0.75 μF
c. 8 μF
d. 0.46 μF

Fourth Question (Choose the most accurate answer) (12.5 Marks)

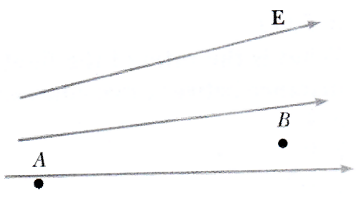
Answer ONLY FIVE of the following ten points (each 2.5 Marks)

1. **A 10 μF capacitor is attached to a 20 V power supply. How much energy is stored in the capacitor?**
a. 2×10^{-3} J
b. 1.2×10^{-3} J
c. 2×10^{-4} J
d. 5.2×10^{-4} J

2. **Inserting a dielectric material between two charged parallel conducting plates, originally separated by air, and disconnected from a battery, will produce what effect on the capacitor?**
a. increase charge
b. increase voltage
c. increase capacitance
d. decrease capacitance

3. **If the net flux through a Gaussian surface is zero, which of the following statements must be true?**
a. The net charge inside the surface is zero
b. The number of electric field lines entering the surface equals the number leaving the surface
c. Both "a" and "b"
d. None of the above

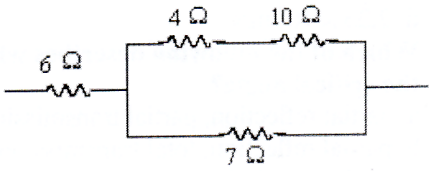
4. **A negative charge is placed at *A* and then moved to *B*. The change in potential energy of the charge–field system for this process is**
a. positive
b. negative
c. zero
d. there is not enough information to determine this



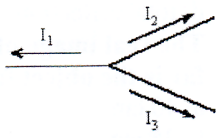
5. **A wire carries a steady current of 0.1 A over a period of 20 s. What total charge passes through the wire in this time interval?**
a. 200 C
b. 20 C

c. 2 C
d. 0.005 C

6. **The charge of 30 C is flowing through a light bulb attached to a 12 V battery in 14 s. What is the total energy delivered to the filament during this process?**
   a. 12 J
   b. 360 J
   c. 5040 J
   d. 168 J
7. **A metallic conductor has a resistivity of 18×10^{-6} Ω·m. What is the resistance of a piece of this conductor that is 30 m long and has a uniform cross-sectional area of 3×10^{-6} m^2?**
   a. 0.056 Ω
   b. 180 Ω
   c. 160 Ω
   d. 90 Ω
8. **A tungsten wire is used to determine the melting point of indium. The resistance of the tungsten wire is 3 Ω at 20 °C and increases to 4.85 Ω as the indium starts to melt. $\alpha_{tungsten} = 4.5 \times 10^{-3}$ °C^{-1}. What is the melting temperature of indium?**
   a. 132°C
   b. 157°C
   c. 351°C
   d. 731°C
9. **Resistors of values 6 Ω, 4 Ω, 10 Ω and 7 Ω are combined as shown. What is the equivalent resistance for this combination?**
   a. 2.3 Ω
   b. 3 Ω
   c. 10.7 Ω
   d. 27 Ω



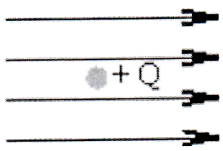
10. **What is Kirchhoff's first law equation for this junction?**
    a. $I_1 = I_2 + I_3$
    b. $I_2 = I_1 + I_2$
    c. $I_3 = I_1 + I_2$
    d. $I_1 + I_2 + I_3 = 0$



Fifth Question (Choose the most accurate answer) (12.5 Marks)

Answer ONLY FIVE of the following ten points (each 2.5 Marks)

1. **An electron which moves with a speed of 3×10^4 m/s parallel to a uniform magnetic field of 0.4 T experiences a force of what magnitude? ($e = 1.6 \times 10^{-19}$ C)**
   a. 4.8×10^{-14} N
   b. 1.9×10^{-15} N
   c. 2.2×10^{-24} N
   d. zero
2. **A stationary positive charge +Q is located in a magnetic field, which is directed toward the right as indicated. The direction of the magnetic force on Q is:**
   a. toward the right.
   b. up.
   c. down.
   d. There is no magnetic force.



3. **A 2 m wire segment carrying a current of 0.6 A oriented parallel to a uniform magnetic field of 0.5 T experiences a force of what magnitude?**
   a. 6.7 N
   b. 0.3 N
   c. 0.15 N
   d. zero

4. **An ultraviolet light wave has a wavelength of 300 nm and speed of 2.1×10^8 m/s through a transparent medium. What is the frequency of this wave in the medium? (1 nm = 10^{-9} m and $c = 3 \times 10^8$ m/s)**
   a. 6.3×10^2 Hz
   b. 9×10^2 Hz
   c. 10×10^{14} Hz
   d. 7×10^{14} Hz
5. **Light from a 560 nm monochromatic source is incident upon the surface of fused quartz ($n = 1.56$) at an angle of 60°. What is the angle of reflection from the surface?**
   a. 15°
   b. 34°
   c. 75°
   d. 60°
6. **When light reflects and produces a clear image, this reflection is referred to as:**
   a. diffuse reflection.
   b. retro-reflection.
   c. double reflection.
   d. specular reflection.
7. **Water has an index of refraction of 1.333. What is the speed of light through it? ($c = 3 \times 10^8$ m/s)**
   a. 4×10^8 m/s
   b. 4.46×10^8 m/s
   c. 1.46×10^8 m/s
   d. 2.25×10^8 m/s
8. **Which of the following describes what will happen to a light ray incident on a glass-to-air boundary at greater than the critical angle?**
   a. partial reflection, partial transmission
   b. partial reflection, total transmission
   c. total transmission
   d. total reflection
9. **The real image of an object is located 45 cm away from a concave mirror, which has a focal length of 10 cm. How far is the object from the mirror?**
   a. 40 cm
   b. 35 cm
   c. 22.5 cm
   d. 12.9 cm
10. **An object is placed at a distance of 30 cm from a thin convex lens along its axis. The lens has a focal length of 10 cm. What are the values, respectively, of the image distance and magnification?**
    a. 60 cm and 2
    b. 15 cm and 2
    c. 60 cm and –0.5
    d. 15 cm and –0.5

GOOD LUCK