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**BITS, PILANI - DUBAI**
**II YEAR SECOND SEMESTER,2010-2011**
**COMPREHENSIVE EXAMINATION (Closed book)**

**Course Title: Measurement Techniques –I (Chemistry)** **Max Marks: 40**
**Course No: TA C211 Question paper contains 4 pages** **Date: 24.5.2011**

Name : Section No:
ID Number :

1. Which group in tartaric acid is responsible for the brisk effervescence when treated with sodium bicarbonate solution ? **(2M)**

2. What happens when glucose is treated with Fehling's solution? Give the relevant chemical equation. **(2M)**

3. Which test is used to detect the presence of polyhydroxy group in carbohydrates? **(2M)**

4. Write the confirmatory test for identifying oxalic acid in the laboratory with appropriate chemical equation. **(2M)**

5. Write the units of second order reaction rate constant. **(2M)**

6. Write the rate expression for the acid catalysed hydrolysis of methyl acetate. **(2M)**

7. Write the purpose of adding ice cold water to the reaction mixture in the experimental determination of acid catalysed hydrolysis of ester. **(2M)**

8. How will you determine the molar conductance at infinite dilution for a strong and weak electrolyte ? **(2M)**

9. Calculate the molar conductivity of 0.050 M NaOH solution . The resistance of the solution is 31.6 Ω and the cell constant is 0.367 $cm^{-1}$ . **(4M)**

10. Draw the pH titration curve for acetic acid Vs sodium hydroxide and indicate the stoichiometric point . **(3M)**

11. Write the Henderson- Hasselbalch equation. **(2M)**

12. How does $KMnO_4$ act as a self indicator ? **(2M)**

13. What is the molarity of 5.30 g of $Na_2CO_3$ dissolved in 400.0 ml solution? **(2M)**
(Molar mass of $Na_2CO_3$ = 106 )

14. . Balance the following redox equation in basic medium. **(2M)**

$$MnO_4^- + CN^- \longrightarrow MnO_2 + CNO^-$$

15. Mention the refluxing time and temperature maintained in the preparation of acetanilide. **(3M)**

16. In the preparation of acetanilide which substance acts as a lewis base ? **(2M)**

17. Draw the experimental set up used for the preparation of acetanilide clearly writing the contents of the reaction mixture. **(4M)**

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# BITS Pilani, Dubai Campus

**Dubai International Academic City, Dubai**

Course Name : Measurement Techniques – I (Biology) Max Mark: 40
Course Number: TA C211 Date: 24.05.2011

**2nd Semester 2010-2011**

| | |
|---|---|
| **Name :** | |
| **ID Number:** | **Section Number:** |

1. **What is the duration of Anaphase in onion root tip if the number of interphase cells is 185, number of mitotic cells is 55 and the number of mitotic cells in anaphase is 18?** **[4]**

**2. Fill in the blanks:** **[8 x 1 = 8 Marks]**

a) Aspergillus species are mainly identified by their _____ hyphae and stalks having a large _____.

b) The stain Bismarck brown gives _____ colour to acids.

c) Expand BSA: _____.

d) Name the stain used in the yeast cell viability count experiment: _____.

e) The Non-Dividing phase of the cell cycle is known as _____.

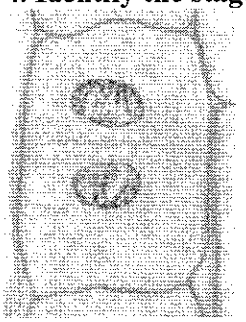
f) The ability of lens to distinguish between two closely related points is _____

g) The formula for viability is: _____.

3. **Differentiate between the following: [1 Major Point Only]** **[2 X 1 = 2 Marks]**

| 1. | TEM | SEM |
|---|---|---|
| | | |
| 2. | Moist Heat Sterilization | Dry Heat Sterilization |
| | | |

**4. Identify the stage depicted below: _____** **[2]**



**Justify your answer:**

**5. Define the following:** **[4x1=4 Marks]**

a. Least Count:

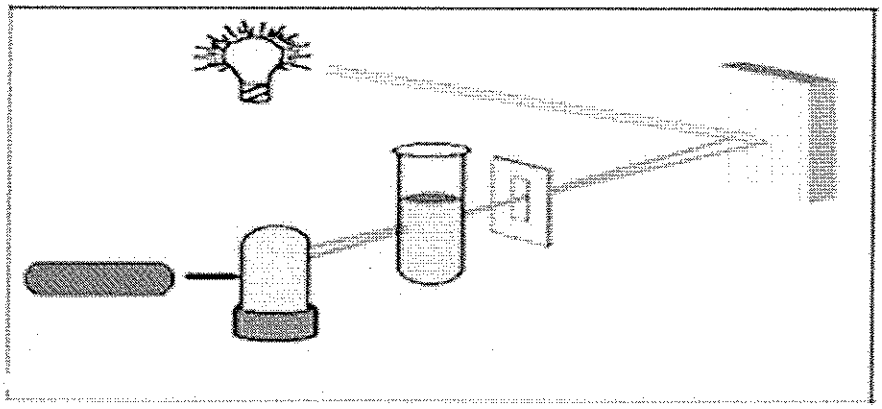
b. Spectroscopy:

c. Dye Exclusion Method:

d. Flocculation:

**6. Calculate the salinity of the water sample if the initial and final readings of the burette are 18.6 and 19.2 ml for $AgNO_3$. Write the relevant formulae also.** **[4]**

7. **Label any four parts of the spectrophotometer and indicate each part's major function:**



**[4]**

8. **(a) State Beer – Lambert's law.** **[5 X 2 = 10 Marks]**

**(b) What are the chemicals required to quantitatively estimate glucose by Dinitrosalicylic Method?**

**(c) What is the endpoint of Mohr's method?**

**(d) Name the ingredients of Sabouraud Dextrose Broth.**

**(e) Write down the oxidation and reduction reactions involved in the glucose estimation experiment.**

9. **Calculate the calibration constant, given that 6 divisions of retical scale coincides with 10 divisions of stage micrometer.** **[2]**

MTI – Physics

**Given:** $c = 2.998 \times 10^{8}\ ms^{-1}$; $\mu_o = 4\pi \times 10^{-7}\ Hm^{-1}$; $\varepsilon_o = 8.85 \times 10^{-12}\ F/m$; $h = 6.63 \times 10^{-34}\ Js$;
$e = 1.602 \times 10^{-19}\ C$; $m_e = 9.1 \times 10^{-31}\ Kg$; and $m_p = 1.67 \times 10^{-27}\ Kg$.

1. A coil with 200 turns of wire is wrapped on an 18.0 cm side square frame. Each turn has the same area equal to that of the frame. A uniform magnetic field is applied perpendicular to the plane of the coil. If the field changes uniformly from 0 to 0.5 T in 0.8 seconds, find the magnitude of induced e.m.f in the coil while the field is changed.
2. Find the inductance of a uniformly wound solenoid of area of cross-section A with N turns and length L. Assume that L is large compared with the radius and that the core of the solenoid is air.
3. The de Broglie wavelength an electron moving at $3 \times 10^{6}\ ms^{-1}$ is.....
4. What is the necessary condition on path length difference between two waves that interfere a) constructively and b) destructively.
5. Monochromatic light from a helium- neon laser ($\lambda = 632.8nm$) is incident normally on a diffraction grating containing 6000 lines/ cm. Find the angle at which the second order maximum will be observed.
6. Two strong lines in the spectrum of sodium have wavelengths 589.0 nm and 589.59 nm. What is the resolving power of the grating be in order to distinguish these wavelengths.
7. If a charged particle q enters with velocity v in a magnetic field B at an angle $\theta$ with B, the force experienced by the particle is
   (a) zero (b) qvB (c ) $qvB\sin\theta$ (d) $qvB\cos\theta$
8. A 1.22KeV electron is circulating in a plane at right angles to a uniform magnetic field B. The orbit radius is 24.7 cm. What is the magnitude of magnetic field?
9. A parallel beam of light of wavelength $5000A^{0}$ in incident normally on a single slit of width 0.001mm. The light is focused by a convex lens on a screen placed in a focal plane. At what angle the first diffraction minimum will be formed.
10. Which of the following does not support the wave nature of light?
    (a) Interference (b) Diffraction (c) Polarization (d) Photoelectric effect

.....**SPACE FOR ROUGH WORK**.....

11. Find the maximum kinetic energy (in eV) of photoelectron, if the work function of the material is 2.45eV and frequency of the radiation is $3.2 \times 10^{15}$Hz.
12. A body of mass 1kg, moving with a speed of 10 $ms^{-1}$ makes a collision with another mass of 2kg moving with 8 $ms^{-1}$ in the same direction. If they move together after collision, how much kinetic energy is dissipated during the collision?
13. A marble with velocity $v_1$ strikes a stationary identical marble elastically and head-on. The final velocities of the shot and struck marbles, respectively are
    (a) $-v_1$ and $2v_1$ (b) ½ $v_1$and ½ $v_1$ (c) $-v_1$ and zero (d) zero and $v_1$
14. The current developed in a solar cell when it is exposed to light from a lamp is due to
    (a) only heat from the source (b) only light from the source
    (c)heat and light from the source (d) none of these
15. A flat ribbon of width 2.0 mm and thickness 150 μm is immersed in a perpendicular uniform magnetic field of strength 8.2 T. A current of 1.5 A is passed along the length of the ribbon, and a transverse voltage equal to 375μV is measured across its width. What is the average velocity of the electrons in the metal?
16. Using the information in the above problem, find the number of conduction electrons per unit volume in this metal?
17. Soft iron alloys are used as transformer cores because their
    (a) area of hysteresis is large (b) retentivity is high
    (c) coercivity is high (d) magnetic saturation limit is high and retentivity and coercivity are small.
18. When a ferromagnetic substance is heated to a temperature above its curie temperature, it
    (a)behaves like a paramagnetic substance (b) behaves like a diamagnetic substance
    (c)remains ferromagnetic (d) is permanently magnetized
19. A string of length 1 m is pulled by a force of 40 N. What will be its lowest frequency of vibration? ($\rho = 8.8$ g/$cm^3$, r = 0.2 mm)
20. In a plot of voltage (V) and frequency (f) of a parallel tuned circuit, the frequency corresponding to the peak value of V is
    (a)maximum Q value (b) minimum Q value
    (c)natural frequency of the circuit (d) maximum frequency of the external circuit

.....SPACE FOR ROUGH WORK.....

**MT-1 Chemistry**

**BITS, PILANI - DUBAI**
**II YEAR Second Semester , 2010-2011**
**Written Viva Course Title: Measurement Techniques –I (Chemistry)**
**Max Marks: 24** **Course No: TA C211** **Question paper contains 3 pages**
**Date: 15.5.2011**

| Name : | Section No: |
|---|---|
| ID Number : | |

1.Write the functional groups present in the carbohydrates. **(2M)**

2. Which group in tartaric acid reduces silver ions of Tollen's reagent into metallic silver? **(2M)**

3. Write the chemical equation for the acid catalysed hydrolysis of ethyl acetate. **(2M)**

4.List any four parameters on which the rate of a reaction depends. **(2M)**

5. Write the expression used to calculate the molar conductance and specific conductance .**(2M)**

6.What is specific conductivity? Give its unit. **(2M)**

7. Write any 2 types of potentiometric titration. **(2M)**

8. Draw the pH curve for the titration of a weak acid vs strong base and indicate the stoichiometric point. **(2M)**

9. Balance the following redox equation in acidic medium (2M)

$$I_2(s) + OCl^-(aq) \rightarrow IO_3^-(aq) + Cl^-(aq)$$

10. Calculate the molarity of 500 ml NaOH solution containing 25 gm NaOH.(Molar mass of NaOH = 40) **(2M)**

11. In the preparation of acetanilide which substance is acting as the nucleophile? **(2M)**

12. During the preparation of acetanilide ,the reaction mixture is poured into ice cold water .Why? **(2M)**

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**BITS PILANI DUBAI (SECOND SEMESTER 2010-11)**

**Written Viva-2(CLOSED BOOK)**

Course No: **TA C211** Course Title: **MEASUREMENT TECHNIQUES-1 ( P H Y S I C S )**

TIME: 30 Minutes DATE: 15.05.2011 MAX. MARKS: 24

**NAME:** **ID. NO:** **SEC NO:**

Note: There are 24 questions. You have to answer any 12 questions. Each question carries 2 marks.
**You have to write all the answers on the top sheet (page-1) attached with the question paper.**

| QN. | ANSWER |
|---|---|
| | |
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Recheck Request:

**Given:** $c = 2.998 \times 10^{8}\ ms^{-1}$; $\mu_o = 4\pi \times 10^{-7}\ Hm^{-1}$; $\varepsilon_o = 8.85 \times 10^{-12}\ F/m$; $h = 6.63 \times 10^{-34}\ Js$;
$e = 1.602 \times 10^{-19}\ C$; $m_e = 9.1 \times 10^{-31}\ Kg$; $m_p = 1.67 \times 10^{-27}\ Kg$

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### e/m ratio of the electron:

1. An electron with a speed v moves in a circle of radius r in a uniform field B. The speed of the electron is now doubled. What will be the new radius of the circular path?
2. An electron of mass m and charge e is accelerated by a potential difference ΔV enters in a magnetic field B (velocity is perpendicular to B). Write e/m in terms of B, ΔV and radius r of the circular path of electron.

### Single slit and double slit:

3. In a double slit experiment, the distance of the screen from the slit is 52cm, the wavelength of the light used is 480nm and the width of the central maxima is 10mm. The distance between the slits is 0.12mm. What is the slit width?
4. In the above question what is the spacing between consecutive maxima?

### Planck's constant:

5. In photoelectric effect if frequency of incident light decreases, what is the effect on photo-current.
6. If the intensity of incident light increases, what is the effect on stopping potential?

### Induction of solenoid:

7. The magnetic field between the poles of an electromagnet is uniform at any time, but its magnitude is increasing at a rate of 0.02T/s. The area of the conducting loop in the field is 120 $cm^2$ and the total circuit resistance is 5Ω. Find the induced emf and induced current in the circuit.
8. A circular loop of wire is in a region of uniform magnetic field. The magnetic field is directed into the plane of the paper. Determine the direction (clockwise or anti clockwise) of the induced current in the loop when a) B is increasing, b) B is decreasing and c) B is constant.

### Electron diffraction:

9. Red light falls normally on a diffraction grating ruled 4000 lines/cm and the second order image is diffracted 34° from the normal. Compute the wavelength of light.
10. A single slit of width d=0.1 mm is illuminated by parallel light of wavelength 600nm, and diffraction bands are observed on the screen 40 cm from the slit. How far is the third dark band from the central bright band?

### Fine structure:

11. To break a chemical bond in the molecules of human skin and cause sunburn, photon energy of about 3.5 e V is required. To what wavelength does this correspond?
12. 4. A laser beam (λ = 633nm) from a typical laser for student use has an intensity of 3m W. How many photons pass a given point in the beam each second?

## Vibrations of string:

13. A string of length 12 m that is fixed at both ends supports a standing wave with a total of 5 nodes. What are the harmonic number and wavelength of this standing wave?
14. A string of length 10 m and mass 200 g is fixed at both ends, and the tension in the string is 32 N. What is the frequency of the standing wave for which the distance between a node and the closest antinode is 1 m?

## RLC circuits:

15. A circuit has L = 12 mH, C = 1.6 μF, and R = 1.5 Ω. What is the frequency at which this circuit would resonate to an external frequency?
16. In the above question, what is the Impedence, Z, at resonance?

## Hall effect:

17. A strip of copper 150 μm thick is placed in a magnetic field B = 0.65 T perpendicular to the plane of the strip, and a current I = 23 A is set up in the strip. What Hall potential difference $\Delta V_H$ would appear across the width of the strip if there were one charge carrier per atom? ($n = 8.49 \times 10^{28}$ electrons $m^{-3}$)
18. If the Hall coefficient is 0.21, find the electron concentration of n-doped specimen.

## ılar cell:

19. The p- type semiconductor is positively charged and n-type semiconductor is negatively charged. Is the statement correct? Why? If not, why not?
20. What is meant by forward and reverse bias?

## Elastic collision:

21. Two bodies of mass 20 g and 30 g are approaching each other with speeds of 6 $ms^{-1}$ and 8 $ms^{-1}$ respectively. After collision if they stick together and move with a speed of 'V', find the value of V.
22. Distinguish between elastic and inelastic collisions.

## Ferromagnetic hysteresis:

23. From the figure-1, find the values of Retentivity and Coercivity of the sample-①.

24. The hysteresis loop for a certain magnetic material is drawn to the following scale. 1 cm = 1 $Acm^{-1}$ and 1 cm = 0.05 $Wbm^{-2}$. The loop area is 90 $m^2$ and the density of the material is 7800 $kgm^{-3}$. Find the hysteresis loss in watt per kg at 50 Hz.

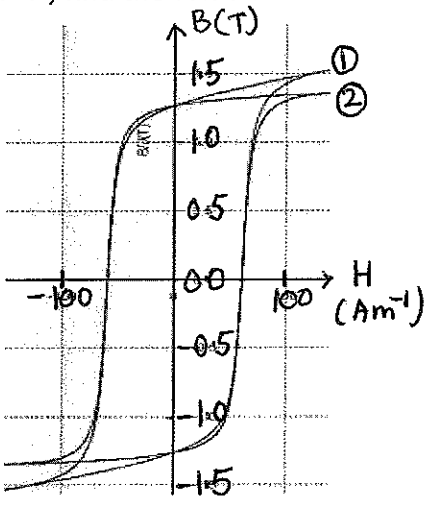


Figure-1

**MT-1 Chemistry**

**BITS, PILANI - DUBAI**
**II YEAR Second Semester , 2010-2011**
**Written Viva Course Title: Measurement Techniques –I (Chemistry)**
**Max Marks: 24** **Course No: TA C211** **Question paper contains 3 pages**
**Date: 27.3.2011**

| Name : | Section No: |
|---|---|
| ID Number : | |

1. Which group in tartaric acid is responsible for the brisk effervescence when treated with sodium bicarbonate solution ? **(2M)**

2. What happens when aqueous solution of glucose is treated with Fehling's solution ? Give the relevant chemical equation. **(2M)**

3. Write the chemical equation for the acid catalysed hydrolysis of methyl acetate. **(2M)**

4. Write the units of first order and second order reaction rate constant. **(2M)**

5. How will you determine the molar conductance at infinite dilution for a strong and weak electrolyte ? **(2M)**

6. How will you verify the Ostwald's dilution law graphically for acetic acid ? **(2M)**

7. At the half way point in the titration of a weak acid versus strong base , the pH was measured as 4.70 . Calculate the ionization constant of acid. **(2M)**

8. Draw the pH curve for the titration of a strong acid vs strong base and indicate the stoichiometric point. **(2M)**

9. Balance the following redox equation in acidic medium

$$MnO_4^-(aq) + Br^-(aq) \rightarrow MnO_2(s) + BrO_3^-(aq)$$ **(2M)**

10. Calculate the molarity of a solution made by dissolving 2.5g of NaCl in water to make 125 ml of solution .(Molar mass of NaCl= 58.5) **(2M)**

11. Mention any two functions of zinc in the preparation of acetanilide. **(2M)**

12. Why prolonged heating of aniline and use of excess acetic anhydride is not advisable during acylation reaction ? **(2M)**

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**Rough Work**

**Given:** $c = 2.998 \times 10^{8}$ m/s; $\mu_o = 4\pi \times 10^{-7}$ M/Amp$^2$ ; $\varepsilon_o = 8.85 \times 10^{-12}$ F/m;
$h = 6.63 \times 10^{-34}$ J.s; $e = 1.602 \times 10^{-19}$ C; $m_e = 9.1 \times 10^{-31}$ Kg; $m_p = 1.67 \times 10^{-27}$ Kg

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**e/m ratio of the electron**

1. A beam of protons is moving horizontally towards you. As it approaches, it passes through a magnetic field directed downward. This magnetic field deflects the beam to your.....
2. An electron is accelerated from rest through a potential difference of 3750V. It eneters a region where B=4mT perpendicular to its velocity. Calculate the radius of the path it will follow in mm?

**Single and double slit**

3. The interference pattern of two slits separated by a distance 0.25mm is observed on a screen at a distance 1m from the slits. The slits are illuminated by a light of wavelength 589.3nm.Calculate the separation between the adjacent bright bands in mm?
4. If the phase difference between the two waves is $4\pi$ , what is the corresponding Path difference

**Planck's Constant**

5. What is the work function (in eV)of the sodium metal if the photoelectric threshold wavelength is 680nm?
6. Will photoelectrons be emitted from a copper surface, of work function 4.4eV, when illuminated by visible light? Explain your answer.

**Induction of solenoid**

7. What is the magnetic flux through area 1.5mx0.75m inclined $70^0$ to a magnetic field of 1.33T?.
8. An average induced e.m.f of 0.2 volts appears in a coil when the current in it is changed from 5.0 A in one direction to 5.0 A in the opposite direction in 0.2 sec. Find the self inductance of the coil.

**Electron Diffraction**

9. What is the difference between crystalline and amorphous materials.
10. Why are X-rays prefered over visible light to determine crystal structure.

**Fine Structure:**

11. Determine the interplanar spacing when a beam of X-ray of wavelength 1.54 A.U. is directed towards the crystal at an angle of 20.3° to the atomic plane.
12. What are the advantages of using a grating over a prism to study spectra in the visible region.

**Vibrations On Strings**

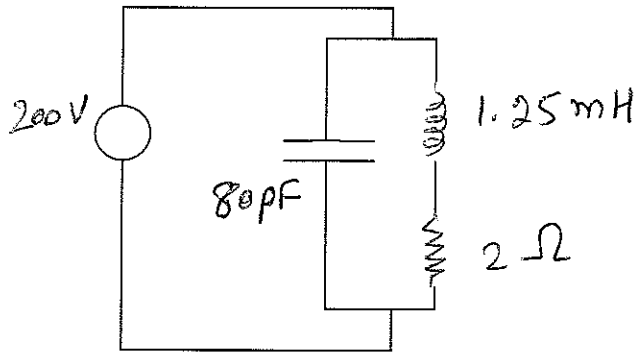
13. A long wire is oscillating transversely so that its displacement has the equation $y(x,t) = A \cos(k_0 x - \omega_0 t)$, where A = 12 millimeters, $k_0 = \pi\ m^{-1}$, and $\omega_0 = 100\ \pi s^{-1}$. The string has a density of 1 g/m. With what speed is the wave moving down the wire?
14. What is the tension of the wire in the above problem ?

**RLC Circuits**

15. Parallel resonant circuits have _____ impedance at resonance (maximum/minimum)

16. The resonant frequency of the circuit below is:

a) 50.3 MHz
b) 503 kHz
c) 7.8 Mhz
d) 2.0 Mhz




**Ferromagnetism**

17. Ferromagnetism is due to:

a) uncompensated charge in the atomic nucleus;
b) paired electrons in the d-shell of transition metals;
c) the spin and orbital properties of atomic electrons;
d) transitions from donor levels to the conduction band;
e) none of the above.

18. Magnetic domains:
a) have the same size and shape as grains in a polycrystalline material;
b) are regions of a material where all the atomic magnetic moments are aligned;
c) are only found in hard magnetic materials;
d) are only found in soft magnetic materials;
e) are due to electrical dipoles.

**Hall Effect**

19. A proton is projected into the uniform magnetic field B with a velocity v such that v.B is zero. The force experienced by the proton is F. Instead, an alpha particle is projected with same speed but at an angle $60^0$ to B. Find the force experience by it. (Express your answer in terms of F only)

20. What is Hall effect?

**Solar Cell**

21. Draw the V-I characteristic curve for a p-n diode in both forward bias and reverse bias

22. What is a thermopile?

**Elastic Collision**

23. If momentum of a body of constant mass increases by 50% then find the percentage increase in kinetic energy of that body.

24. If the two bodies stick together after a collision then what type of collision should have occurred?