

## Sample Paper – 2008

**Class – Physics**

**Class – XII**

- Q.1. What is quantization of charge. What is its cause? Can a body have a charge of  $18 \times 10^{-20} \text{ C}$ ?
- Q.2. Describe how a metallic rod can be made positively charged by the method of induction.
- Q.3. State 4 essential differences b/w charge and mass
- Q.4. A glass rod is rubbed with a silk cloth. Explain what will happen to their mass and charge? Why does this change occur?
- Q.5. What are electric field lines? Mention 4 properties.
- Q.6. State coulomb's law in vector form and give the value and units of  $\epsilon_0$ . Explain superposition principle using a suitable figure.
- Q.7. 2 charges are placed  $R$  mts apart in air. The repulsive force b/w them is found to be  $F$ . Find the force when the same charges are placed in water at a distance of  $2R$ . ( $\epsilon_r = 80$ ). Will this force be attractive or repulsive?
- Q.8. Derive the value of electric field at the axial and equatorial point of a dipole made of charges  $+q$  and  $-q$  placed a distance  $2a$  apart.
- Q.9. Draw electric field lines for uniform electric field. How can this type of electric field be created. A dipole is made of  $+2\mu\text{C}$  and  $-2\mu\text{C}$  placed  $5\text{mm}$  apart. Find its dipole moment and derive the expression for the torque acting on it when it is placed in a uniform electric field.
- Q.10. A charge of  $5\text{C}$  is placed at the origin and  $-10\text{C}$  is placed at the point  $x = 30$ . Find a point on the  $x$  axis at which (a) Electric field is zero (b) Potential is zero
- Q.11. 3 charges of  $5\text{C}$  each are kept on the corners of a square of side  $1\text{m}$ . Find the electric field and potential at the fourth corner.
- Q.12. Derive the value of electric potential at an axial point of a dipole. Show that the equatorial line of a dipole is equipotential

Q.13. Four charges of 1C each are kept on the corners of a square of side 2m. Find the total potential energy of the system.

Q.14. State Gauss theorem and using it derive the value of electric field at a point R mts away from an infinite line of charge having charge density  $\lambda$  C/m

Q.15. Using Gauss theorem derive the value of electric field due to an infinite sheet of charge having charge density  $\sigma$  C/m<sup>2</sup>. Draw a graph showing the variation of electric field with distance R

Q.16. Write 5 points about the behavior of conductors in electric field

Q.17. A parallel plate capacitor is made of 2 plates having area A separated by a distance d.

A dielectric slab of thickness d/4 and having dielectric constant 100 is introduced in b/w the plates. Derive the capacitance of this capacitor

Q.18. Two capacitors when joined in series give a net capacitance of 2F and when these capacitors are joined in parallel, the net is 9F. Find the values of the two individual capacitors

Q.19. Explain the following terms

- (a) Electrostatic shielding      (b) Faraday cages      (c) Dielectric constant  
(d) Polarization      (e) Electric potential      (e) Electric flux

Q.20. The potential at point A is 10 volts and at point B is 20 volts. What is the direction of electric field b/w A and B. Find the amount of work done in moving a charge of 2C from point A to point B.

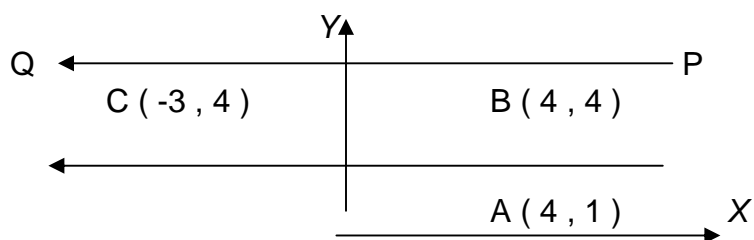
(b) What is the amount of work done in moving a 100nC charge b/w two points 5cm apart on an equipotential surface

Q.21. A spherical Gaussian surface encloses a charge  $8.85 \times 10^{-8}$ C. Calculate the electric flux passing through the surface. If the radius of the Gaussian surface is doubled, how would the flux change

(b) A charge of  $8.85 \times 10^{-8}$ C is placed inside a cube of side 1mm. Find the total flux and the flux through one of the faces.

Q.22. What is an equipotential surface. A uniform electric field of 300 N/C is directed along PQ.

A, B and C are three points in the field having x and y coordinates as shown in the figure. Calculate potential difference b/w A & B, A & C and B & C.



Q.23. Derive the value of electric potential at a distance R from a point charge Q

Q.24. A capacitor of 60C is connected to 200V supply and another capacitor of 30C is connected to 100V . Find the charge and energy stored on each capacitor. Now these 2 capacitors are disconnected from the supply and are joined to each other such that positive plate of 1<sup>st</sup> is connected to positive plate of 2<sup>nd</sup> and similarly negative plates of both are also joined together. Find the loss in energy for the system. Why does this loss occur.

Q.25. Describe the construction and working of the VanDe Graff generator

**Sample Paper - 2008**  
**Class - XII**  
**Subject - Informatics Practices**

**Time : 3 hours**

**Max Marks :70**

**SECTION - A**

**Q 1. Answer the following questions:**

- a. What is meant by terms computing, business computing and business computing system?  $\frac{1}{2} + 1\frac{1}{2} = 2$
- b. Explain Inventory. What is the role of Inventory Control System?  $1 + 3 = 4$

**Q2. Answer the following questions:**

- a. Illustrate major difference between Front End Technologies and Back End Technology, in Terms of software projects. Give one example of each. 4
- b. What is feasibility study? What points are covered in feasibility study done by a system Analyst?  $1 + 2 = 3$

**Q3. Answer the following questions:**

- a. What is ER Model? Define entity, attribute and relationship.  $1\frac{1}{2} + \frac{1}{2} = 2$
- b. What is DDLC? How does it differ from SDLC?  $\frac{1}{2} + \frac{1}{2} = 1$
- c. What do you understand by following terms?  
(i) MySQL (ii) Mozilla (iii) Python (iv) PHP  $1 + 1 + 1 + 1 = 4$

**SECTION - B**

**Q4. Answer the following questions:**

- a. NDPS offers two crash courses, one in computers and the other in Commerce. The students can avail certain optional facilities. The Basic Interface for accepting the details of facilities availed by a student are as under:



Write the code and event procedures for incorporating the following functionality:

- (i) The LIBRARY facility should be selected by default 1
- (ii) The default choice of course should be MCA. 1
- (iii) The Transport facility should tie up with mess facility 1
- (iv) Assume that the charges for library, mess and Transport are Rs. 500, Rs.1200 and Rs. 1000 respectively. Write a function that calculates the charges per session (2 months), for the facilities availed including registration fees Rs.500. 2

**Q5. Answer the following questions:**

- a. What are dynamic arrays explain with suitable example. 2
- b. What are modules? What types of modules are supported in VB? Give example to support your answer. 1+3+1=5

**Q6. Answer the following questions:**

- a. Write a function that takes two String arguments and returns 0 if both the arguments are equal. The function returns - 1 if the first argument is smaller than the second, and 1 if the second argument is smaller than the first.

2

b. Find the output of the following program:

4

```
Private Sub Command1_click()
```

```
Dim a, b, c as Long
```

```
a=7
```

```
b=6
```

```
c=add((a),(b))
```

```
Print " The sum is : "&c
```

```
End Sub
```

```
Private Function add(x&, y as long) as long
```

```
add=x+y+10
```

```
End Function
```

b. What you know about Mid statement ? How is it differ from Mid( ) function ?  
2+2= 4

### SECTION - C

Q7. Answer the following questions:

a. Read this table carefully and answer the following question:

Scholar_N o	Student_Name	Last_Exa m	This_Exa m	Total
2006106	Avisha Rathore	78	80	
2004111	Miti Goyal	89	89	
2004123	Mitali Narang	92	90	

Create a TRIGGER to flash out error message on UPDATE of Marks of last exam of any record of a Student

4

b. How are SDI applications different from MDI applications? Can a SDI applications have multiple forms, what makes them significantly different from each other?  
2+3=5

Q8. Answer the following questions:

a. Write short notes on following.

1+1+1+1=1=5

(i) Data Provider

(ii) OLE DB

(iii) DSN (Data Source Name

(iv) Connection Object

(v) *Command Object*

b. Write VB statements to perform the following:

(Where Data control object is ADODB1)

(i) Move to the last record of a record set.

(ii) Move to the previous record.

(iii) Move to next record in case EOF is not reached otherwise move to first record

Q9. Answer the following questions:

a. What is a transaction in PL/SQL? What commands are available in PL/SQL for transaction handling?

b. What is meant by functional dependency? Give example of function.

c. What is the need for normalisation? Define third normal form.

d. What is the difference between IN and OUT parameters of Store procedure?

Sample Paper – 2008  
Class – XII  
Subject – Informatics Practices

SUBJECT: IP

TIME: 3HRS

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**General instructions**

Read all the questions carefully

All questions are compulsory

Section A contains 30marks, section B and section C contains 20 marks each

**Section A**

Q1.

(i) Define the following terms 1x5

- a. Scope of a variable
- b. Lifetime of a variable
- c. Parameter
- d. Procedure
- e. Module

(ii) Differentiate between the following: 2x3

- a. SDI and MDI
- b. Implicit and explicit declaration of a variable in VB
- c. Picture box and image control

(iii) Define the following: 1x4

- a. normalization
- b. primary key
- c. data modal



d. data dictionary

Q2.

(i) You have changed the back color property of OK button to Red but still default color is appearing on the button which property you need to set and what value. 2

(ii) A command button named cmdnext should change its caption to “FOCUS” and becomes enabled when receives the focus. It should again change its caption to “LOST” and become disabled when loses the focus. Design the events to the get the above requirements.

4

Q3.

(i) Write a PL/SQL block for finding out whether a given number is prime number or not. 3

(ii) Explain the limitations of numeric for loop using one example. 4

(iii) Write any two commands of DDL 2

### **Section B**

Q4.

(i) Identify the implicit and explicit variable declarations in the following statements. 2

```
dim a as integer, b as integer
msg= “work hard to get good marks”
a= inputbox (“enter no”)
print a, msg
```

(ii) Examine the code workout what the ‘result’ variable will hold? 2

```
Dim x as string, y as string, z as string
Dim result as string
X=”KUSH”
Y= “Sandy”
Z= “”
Result= x & “and” & y
```

(iii) write a program for displaying the following pattern 3

```
*  
* *  
* * *  
* * * *
```

(iv) Write a program for reading values in a array whose size will be specified by the user. 3

Q5.

- (i) write a function procedure which will read two parameters of integer type, if the first parameter is divisible by the 2<sup>nd</sup> parameter the return true else return false. 4
- (ii) design a login window which will check for username as RAJ and password as PRACTICES and display the second form frm2 , when correct username and password is provided else display a message “ACCESS DENIED “ on a message box. 2
- (iii) Write a procedure will take newvalue and position as parameter, which are of integer type, insert the new value in the specified position in an array. 4

### Section C

Q6.

(i) Find out the errors in the following code:

(a) Declare 2  
A as number;  
B A%type;  
Begin;  
A=10;  
Loop  
Dbms.output.put\_line(B);  
A:= A+1;  
End loop;  
End;

(b) Declare 3

```
A number;  
B emp%type;  
C number;  
Begin  
  
A := &enter no;  
Select job into c where empno= A;  
For I in 4....5  
Loop  
I:=I+1  
Dbms_output.put_line (I);  
End loop;  
C:=I;  
End.
```

(ii) find out the output of the following code

(a) Declare                      2

```
begin  
for I in 1..5  
loop  
dbms_output.Put(I);  
End loop;
```

(b) Declare                      3

```
a number;  
b number;  
c varchar2(3);  
  
begin  
a:= &enter_no;  
b:= &enter_no1;  
c:= '&enter_operator';  
if c= '+' then  
dbms_output.put_line(a+b);  
  
elsif c='- ' then  
dbms_output.put_line(a-b);  
elsif c= '*' then  
dbms_output.put_line(a*b);  
elsif c= '/' then
```

```
dbms_output.put_line(a/b);  
else  
dbms_output.put_line('wrong math operator');  
end if;  
end
```

find out the output for the above code when (i) a=5, b=8 and c= \*, (ii) a=3 , b=4 and c= -

Q7.

(iv) write a sql command for creating a table student whose structure is given below 2

Field name	Datatype	Size	constraint
Rno	Number	3	Part of primary key
Class	Varchar2	5	Part of primary key
Percentage	Number	5,2	>0 and <=100

- (ii) Write a command for adding a field remarks to the above created table whose data type is varchar2 and size is 40 with not null constraint. 2
- (iii) Write a command for creating view student1 on the student table which contain those student records who got 75 and above percentage. 2
- (iv) Write command for giving select and update privileges on the above table to the demo user with grant option. 2
- (v) Write command for removing view student1 from the database. 2

**Sample Paper – 2008**  
**Class – XII**  
**Subject – informatics Practices**

Marks:70

Time : 3 hrs

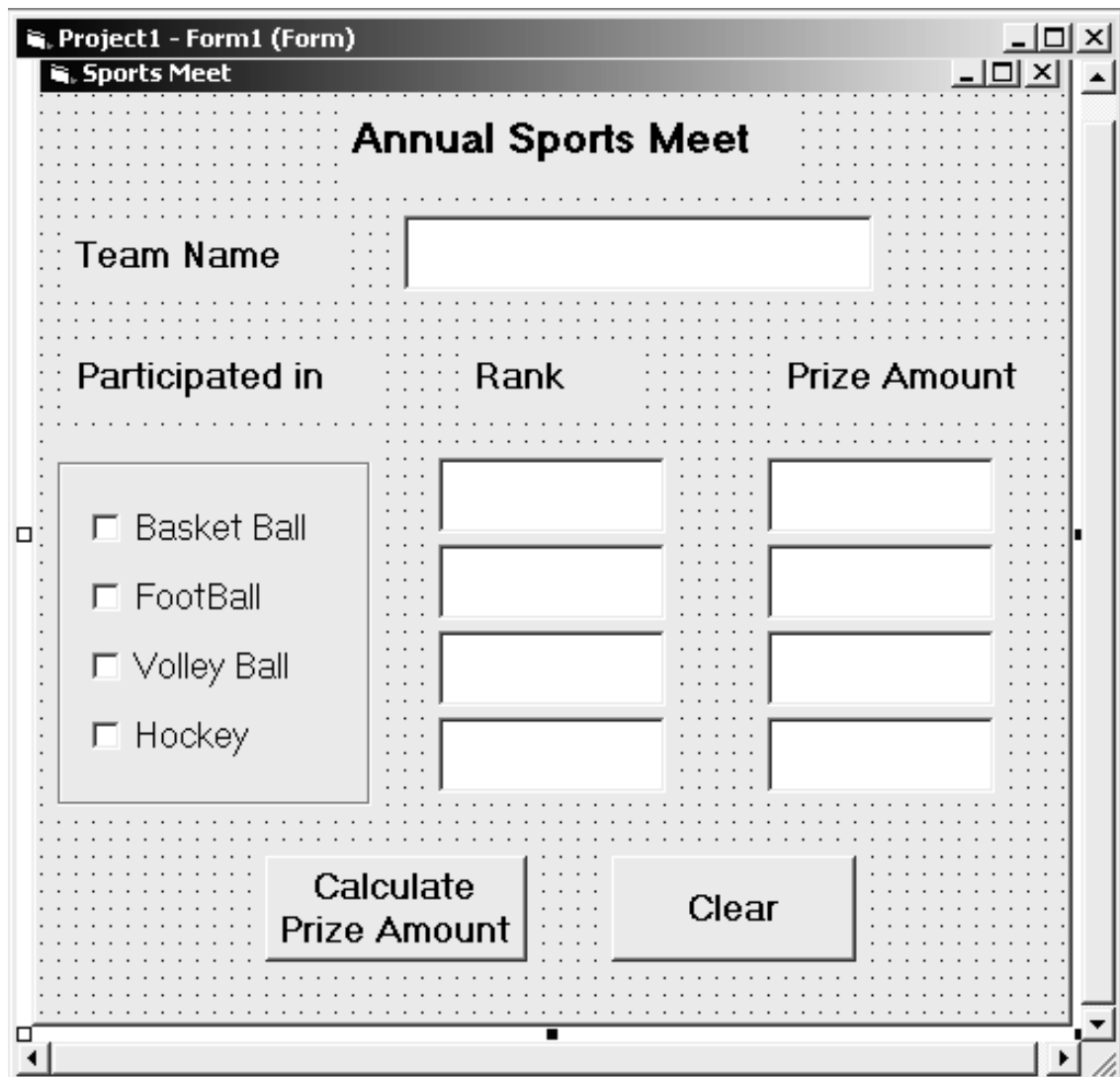
1. Answer the following:-(2\*5)
  - a. Differentiate between public and private variables & discuss their scope visibility.
  - b. Expand the abbreviation ODBC. What does ODBC mean
  - c. What are intrinsic controls? Name any two
  - d. What do you understand by the term Record Source of an ADO data control?
  - e. Write a function in VB to toggle(invert) the case of each character of a string i.e characters in uppercase should be converted to lowercase and vice versa
2. Explain in short:- (2\*5)
  - a. Differentiate between pre-tested and post –tested loop .Give two example of each.
  - b. What is module? What are the different types of modules that can be created in VB ? Define all of them.
  - c. Find the errors from the following code segment and rewrite the corrected code underlining the correction made : 2  
X=90  
Do while x<=100  
    If x mod 6 =0  
        Print x-9  
    Else  
        Print x  
    X=x\*3.4 + 45.98  
Loop while x<=100
  - d. Rewrite the following code segment using For ... Next instead of Do ..until: 2  
Dim total as integer  
Dim n as integer  
Dim l as integer  
N= val (text1.text)  
Do until i< = n  
    Total =total +i  
    l=i+1  
End do
  - e. Give the output of the follwing statements:
    - i. INSTR(LTRIM(" INFORMATICS"), "ma")
    - ii. INT(40-20\*4/3+5)

**3. Read the following case study and answer the questions that follows**

Mr. Vijay has designed a VB form to gather the data regarding the ranks and prize amounts won by different teams in an annual sports meet.

He has used different controls for storing the sports name, rank and the prizeamount respectively. Now he wishes to make the following changes to the application he designed.

Object	Object Name	Description
Form	FrmSports	The main Form Object
Label	Lblname Lblparticipated Lblrank Lblprize	
Text Box	TxtTeamname Txtrnkbasket Txtrnkfootball Txtrnkvolley Txtpzrhockey Txtpzrbasket Txtpzrfootball Txtpzrvolley Txtpzrhockey	To enter Team name To enter rank To enter rank To enter rank To enter rank To enter prize To enter prize To enter prize To enter prize
Check Box	Chkbasket Chkfootball Chkvolleyball Chkhockey	
Command Button	Cmdcalculateprize Cmdclear	To calculate the prize. To clear the text box and check box



The screenshot shows a Visual Basic form titled "Project1 - Form1 (Form)" with a sub-header "Sports Meet". The main title of the form is "Annual Sports Meet". It contains the following controls:

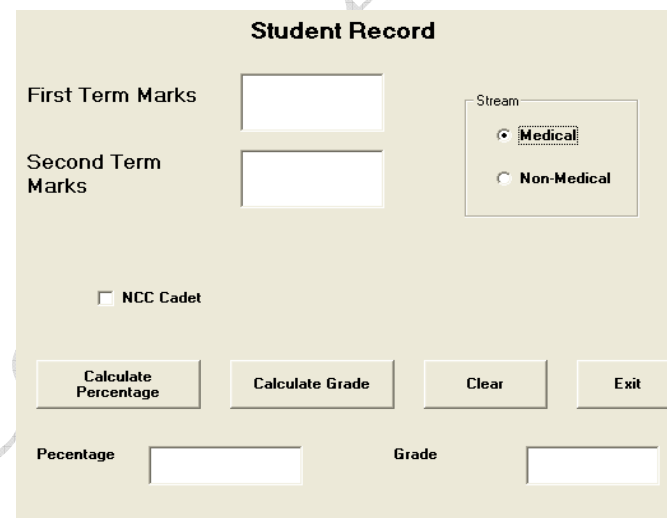
- A text box labeled "Team Name".
- A group box containing four checkboxes: "Basket Ball", "FootBall", "Volley Ball", and "Hockey".
- Three text boxes for "Rank" (arranged vertically).
- Three text boxes for "Prize Amount" (arranged vertically).
- Two command buttons at the bottom: "Calculate Prize Amount" and "Clear".

- The team Name should be displayed in upper case and the text box for rank should be enabled only if the corresponding check box is checked. [3]
  - The text box for prize amount should be enabled only if the corresponding check box is checked [2]
  - The contents of the text box prize amount should be a non-negative number. [2]
  - When the user clicks the command button Calculate Prize Amount, the total prize amount should be displayed in a message box. [2]
  - When the user clicks the clear button, the form should be restored to the default state. [1]
4. . Read the following case study and answer the questions that follow:

Mr. Vidyarthi works in Blossoms Public School as a programmer. He is required to develop a student record. The school offers two different streams, medical and non-medical, with different grading criteria. The school also offers incentive to the NCC cadets in the form of a 3% increment in percentage for all the NCC cadets. The grading criteria for the two streams are given below:

Stream	Percentage	Grade
Medical	$\geq 80$	A
	60-80	B
	$< 60$	C
Non Medical	$\geq 75$	A
	50-75	B
	$< 50$	C

Object Type	Object Name	Description
Form	FrmStudRec	The Main Form object
Text Box	TxtFirstTerm	To enter first term marks
	TxtSecondTerm	To enter second term marks
	TxtPercentage	To display the percentage of the student
	TxtGrade	To display the grade of the student
Check Box	ChkCadet	To be Checked if student is an NCC Cadet
Option Button	OptMedical	To provide Stream Information
	OptNonmedical	
Comm and Button	CmdCalcPer	To calculate the percentage
	CmdCalcGrade	To calculate the grade
	CmdClear	To clear the entered values
	CmdExit	To close the application



The screenshot shows a Windows-style application titled "Student Record". It has a light beige background. At the top, there are two text boxes for "First Term Marks" and "Second Term Marks". To the right of these is a "Stream" section with two radio buttons: "Medical" (which is selected) and "Non-Medical". Below these is a checkbox labeled "NCC Cadet". At the bottom, there are four buttons: "Calculate Percentage", "Calculate Grade", "Clear", and "Exit". Below the buttons, there are two text boxes for displaying the results, labeled "Percentage" and "Grade".

(a) Write the commands to disable the textboxes txtPercentage and txtGrade.

1

(b) Write the code for cmdClear Command Button to clear all the textboxes and the checkbox.

1

(c) Write the code for cmdCalcPer to calculate the percentage after finding the total marks of first term and second term (assuming that both marks are out of 100). Also ensure that NCC cadets get an increment of 3% in their percentages. 4

(d) Write the code for cmdCalcGrade to calculate the grade depending on the stream selected according to the criteria given above.

4

5.

a. Design an application that lets the user enter a line of text and a word to be searched for. It then reports how many times the word has occurred in the line of text

4

b. Rewrite the following code segment using select case instead of if else : 3

```
Dim sal as integer
If sal >=10000 then
    MsgBox (" new year bonus is 2000")
Elseif sal >=12000 and sal <=15000 then
    MsgBox (" new year bonus is 5000")
```



```
Elseif sal= 20000 then
    MsgBox (" new year bonus is 7000")
Else
    MsgBox (" Bonus not applicable")
End if
```

c. Convert the following without using an for loop:- (3)

```
For i=3 to 1 step-1
    if x=1 then
        Print "One"
    elseif x=2 then
        Print "Two"
    elseif x=3 then
        Print "Three"
    Endif
Next
```

6. a. Convert the following into a for loop:- (3)

```
i=99
Do while (i<=33)
    Print i+10
    i=i-3
loop
```

b. Difference between

- a. SDI and MDI 2
- b. Pass ByVal and Pass ByRef 2

c. What are the recordset types? Explain in brief 3  
7

- a. Differentiate between DAO and ADODC? 2
- b. Differentiate between ADODC and ADODB project reference in detail? 4
- c. What are the lock Types? Explain? 2
- d. What is connection object ? Give example and purpose 2

**Sample Paper - 2008**  
**Subject – Physics**  
**CLASS – XII**

**Time: Three Hours**  
**Marks: 70**

**Max.**

**General Instructions**

- (a) All questions are compulsory.
- (b) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.
- (c) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (d) Use of calculators is not permitted.
- (e) You may use the following physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4 \pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\text{Boltzmann constant } k = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

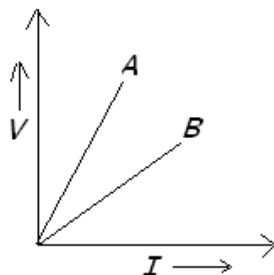
$$\text{Avogadro's number } N_A = 6.023 \times 10^{23} / \text{mole}$$

$$\text{Mass of neutron } m_n = 1.6 \times 10^{-27} \text{ kg}$$

$$1 \text{ MeV} = 1.602 \times 10^{-13} \text{ J}$$

1. What is the change in the collector current in a transistor of a.c current gain 150, for a  $100 \mu\text{A}$  change in the base current?
2. What is Bohr's frequency condition?
3. What is de-Broglie wavelength of an atom at absolute temperature  $T$  K.
4. In a single slit diffraction experiment, the width of the slit is halved. How does it affect the size and intensity of the central maximum?
5. What is the nature of waves used in radar? What is their wavelength range?
6. A metal foil is placed in the middle of a parallel plate capacitor? What is the effect on the capacitance of the system?
7. Why a cyclotron is not suitable to accelerate electrons?
8. How does the quality factor ( $Q$ ) signifies in an LCR A.C circuit?
9. Two point charges  $4\mu\text{C}$  and  $-2\mu\text{C}$  are separated by a distance of 1 m in air. At what point on the line joining the charges is the electric potential zero?

10. An air-core solenoid is connected to an a.c source and a bulb. If an iron-core is inserted in the solenoid, how does the brightness of a bulb change? Give reasons
11. V-I graph for parallel and series combinations of two metallic resistors are as shown in the fig. which graph shows parallel combination? Justify?



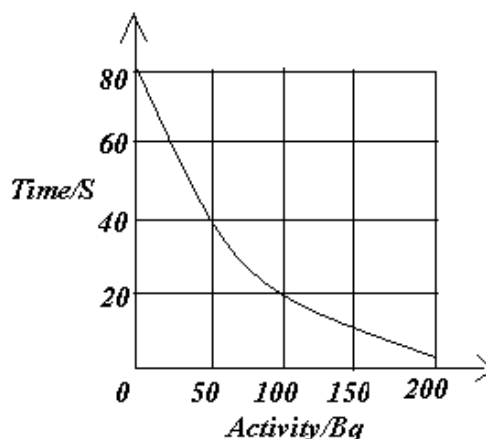
12. Using Gauss's theorem, prove that charges reside entirely on the outer surface of an insulated conductor.
13. Prove that two parallel conductors carrying current in the opposite directions repel each other.
14. Derive expression for the mutual inductance of a pair of co-axial solenoids having number of turns  $N_1$  and  $N_2$ .
15. Arrange the following in ascending order of wavelength; X rays, Microwaves, Radio waves, UV rays. Give any two uses of these radiations.

Or

Write three characteristics of electromagnetic waves. Which part of the electromagnetic waves has highest frequency?

16. The ratio of the intensities at minima to maxima in the interference pattern is 9:25. What will be the ratio of the widths of the two slits in the young's double slit experiment.
17. What is ground wave? Why short wave communication over long distance is not possible via ground waves

18. The graph shows how the activity of a radioactive material changes with time. Using the graph, determine i) Half-life of the material and ii) decay constant.



19. A parallel plate capacitor is charged to a potential difference  $V$  by a d.c source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reasons, how the following will change.
- Electric field between the plates
  - Capacitance of the capacitor and
  - Energy stored in the capacitor.
20. The input resistance of a silicon transistor is  $665\ \Omega$ . Its base current is changed by  $15\ \mu\text{A}$  which results in a change of collector current by  $2\text{ mA}$ . The transistor is used as a common emitter amplifier with a load resistance of  $5\text{ k}\Omega$ . Calculate i) current gain  $\beta_{ac}$  ii) transconductance  $g_m$  and iii) voltage gain  $A_v$  of the amplifier.
21. When an alternating voltage of  $220\text{ V}$  is applied across a device X, a current of  $0.5\text{ A}$  flows through it and is in phase with the applied voltage. When the same voltage is applied across another device Y, the same current flows again through Y but it leads the applied voltage by  $\pi/2$  radians.
- Name the devices X and Y
  - Calculate the current flowing in the circuit when same voltage is applied across the series combination of X and Y

Or

Give any three energy losses in a transformer. Give one method in each to reduce the same.

22. How will the magnifying power of a refracting astronomical telescope be affected on increasing for its eye-piece i) the focal length and ii) aperture? Justify your answer.
23. Explain the following phenomena;
- Sun looks reddish at sunrise and sunset.
  - Two independent source of light can not produce interference fringes?
  - A fish in water appears to be higher than actually it is.
24. What are isotopes? Which of the following radiations  $\alpha$  rays,  $\beta$  rays and  $\gamma$  rays.
- are similar to X rays.
  - are easily absorbed by matter
  - travel with greatest speed
  - are similar in nature to cathode rays
  - can ionize most.
25. What is a rectifier? Explain full wave rectification with a neat circuit diagram. Draw input and output graphs also.
26. Show that the de- Broglie wavelength of electron of energy  $E$  is given by the relation

$$\lambda = \frac{h}{\sqrt{2mE}}$$

27. a) Why TV signals cannot be propagated by a sky wave? How can you increase the range of TV signals?

b) If the frequency of a plane electromagnetic wave is 60 MHz, what is the wavelength of the wave.

28. Four double convex lens of the following specifications are available:

Which two of the given four lenses should be selected as the objective and eye-piece to construct a compound microscope and why? How can the magnifying power of such a microscope can be increased?

Lens	Focal length	Aperture
A	100 cm	10 cm
B	100 cm	5 cm
C	10 cm	2 cm
D	5 cm	2 cm

Or

Obtain Lens Makers formula in case of a double convex lens. State the assumptions and conventions of signs used.

29. Define resistivity of a conductor. How does it vary with temperature? A wire of uniform cross-section and length  $l$  has a resistance of  $16 \Omega$ . It is cut in to four equal parts. Each part is stretched uniformly to the length  $l$  and all the four stretched parts are connected in parallel. Calculate the total resistance of the combination so formed. Assume that the stretching of wire does not cause any change in the density of its material.

Or

Explain with the help of a circuit diagram, the use of potentiometer for determination of internal resistance of a primary cell. Derive necessary mathematical expression?

30. Explain the principle and working of a cyclotron with the help of a labelled diagram. A cyclotron oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons? If the radius of its Dees is 60 cm, what is the kinetic energy of the proton beam produced by the accelerator? Express your answer in units of MeV

Or

State Ampere's circuital law. Use this law to find the expression for magnetic field produced by a long straight solid conductor of radius 'a' and carrying a current  $I$  at a distance  $r$  from the axis of the conductor in the region  
i)  $r < a$   
ii)  $r > a$

**Sample Paper**  
**Class – XII**  
**Subject - Physics**

One mark questions for 12<sup>th</sup> Science CBSE Physics

1. What is tangent law
2. What are ferrites?
3. What is hysteresis?
4. What is self induction?
5. What are eddy currents?
6. Define one Henry.
7. Define mutual inductance.
8. What is average value of A.C. over one full cycle?
9. What is capacitive reactance?
10. What are wattles current?
11. What is a transformer?
12. Why is core of transformer laminated?
13. What are microwaves?
14. Who discovered infrared waves?
15. Why are microwaves used in RADAR?
16. What is snell's law?
17. Write two conditions for total internal refraction.
18. What is angle of minimum deviation?
19. What is dispersion?
20. Write down the lens maker's formula.

By: Ishmeet

**Sample Paper – 2008**  
**Class – Physics**  
**Class – XII**

***Time allowed : 3 hours***

***Maximum Marks : 70***

***General Instructions :***

- (i) *All questions are compulsory.*
- (ii) *Question numbers 1 to 8 are very short answer type questions, carrying one mark each.*
- (iii) *Question numbers 9 to 18 are short answer type questions, carrying two marks each.*
- (iv) *Question numbers 19 to 27 are also short answer type questions, carrying three marks each.*
- (v) *Question numbers 28 to 30 are long answer type questions, carrying five marks each.*
- (vi) *Use of calculators is not permitted. However, you may use log tables, if necessary.*

**Q.1>** In a hydrogen atom, an electron revolves around a proton. Which of these two exerts a greater electrostatic force on the other?

**Q.2>** What is the force experienced by a positively charged particle  $Q$  moving at right angles to a uniform electric field  $E$ .

**Q.3>** What is the order of voltages that can be built up using a Van De Graff generator?

**Q.4>** What is the angle b/w Electric field and Dipole moment at an axial point?

**Q.5>** Define gyromagnetic ratio. What is its value?

**Q.6>** State the condition in which terminal voltage across a secondary cell is equal to its emf.

**Q.7>** The dielectric strength of air is  $3 \times 10^6$  V/m. What is the maximum charge that can be safely stored on a sphere of radius 10m?

**Q.8>** Name two types of commercially available resistors.

**Q.9>** On the same graph plot the variation of  $E$  versus  $R$  and  $V$  versus  $R$  for a point charge.

**Q.10>** Define mobility and mention its SI unit

**Q.11>** Two resistors are connected in parallel b/w A and B to give a net resistance of 2 ohms. When one of these resistors is broken, the net resistance becomes a 3 ohms. What is the resistance of the resistor that was broken?

**Q.12>** Using a suitable graph, explain why nichrome is used in standard resistance coils.

**Q.13>** A velocity selector is to be designed for particles of velocity 10m/s. What magnetic field should be employed if the electric field in it is 100 N/C

**Q.14>** Explain why a potentiometer is preferred over a voltmeter for measuring potential differences.

**Q.15>** An alpha particle and a proton accelerated by the same potential difference enter into a magnetic field. Find the ratio of their radius and the ratio of their frequency.

**Q.16>** In a meter bridge experiment with a fixed resistor of 10 ohm, the balance length is found to be 75cm. What resistance should be added in series with this fixed resistor so as to bring the null point in the center of the wire.

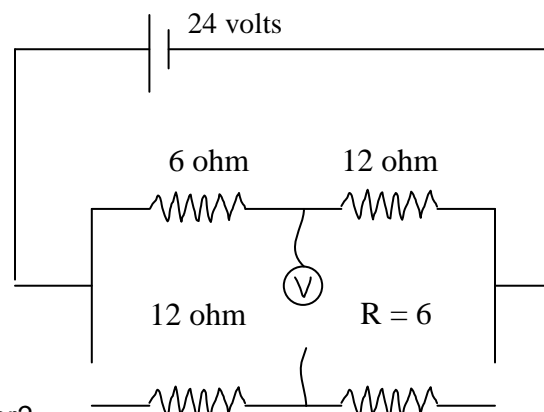
**Q.17>** The resistivity of a metal X is  $3.2 \times 10^{-8}$  while the free electron density is  $5 \times 10^{28} \text{ m}^{-3}$ . Find the drift velocity of electrons if a potential gradient of  $1 \text{ Vm}^{-1}$  is applied across X.

**Q.18>** What type of materials are used for making  
(a) Permanent magnets

**(b) Transformer cores.**

Give two line reasons for each

**Q.19>** In the circuit diagram, what is the reading of the voltmeter?  
(b) What resistance should be connected in series with the  $R = 6 \text{ ohm}$  resistor so that the voltmeter reading become zero?



**Q.20>** Show that the far field of a solenoid resembles that of a bar magnet. Hence define the magnetic moment of a solenoid.

**Q.21>** A long cylinder of radius  $R_0$  is carrying a current  $I_0$ , which is uniformly distributed over its cross section. Derive an expression for the magnitude of magnetic field inside as



well as outside the wire. Plot a curve to show the variation of magnetic field with radial distance.

**Q.22>** A and B are two concentric hollow metallic shells of radius  $R_A$  and  $R_B$ . A is given a charge  $Q_A$  while B is given a charge  $Q_B$ . Find the electric potential at a distance  $R$  from the center such that

(a)  $R < R_A$

(b)  $R_A < R < R_B$

(c)  $R > R_B$

**Q.23>** Derive an expression for the torque acting on a current carrying loop placed in a uniform magnetic field. Hence define the magnetic moment of a current carrying loop.

**Q.24>** Use kirchoff's laws to deduce the condition of a balanced wheatstone bridge.

**Q.25>** Explain mathematically, why the resistance of metals increases while that of semiconductor decreases with the rise in temperature. Plot Resistance versus Temperature for Cu and for Silicon.

**Q.26>** Three charges  $Q$ ,  $Q$  and  $-Q$  are placed on the vertices of an equilateral triangle of side  $L$ . Find the net force experienced by the charge  $Q$  and the net force experienced by the charge  $-Q$ .

**Q.27>** Cell A has an emf  $E_A$  and internal resistance  $r_A$  while cell B has emf  $E_B$  and internal resistance  $r_B$ . Derive an expression for the equivalent emf and internal resistance

**Q.28>** Using a labeled diagram explain the construction and working of a moving coil galvanometer. Define its current and voltage sensitivity and explain how they can be increased.

(b) A galvanometer with a coil resistance of 5 ohm can tolerate a maximum current of 10mA. Explain how this can be converted into an ammeter of range 1A.

**Q.29>** There are a total of  $N$  cells each of emf  $E$  and internal resistance  $r$ . They are connected in the form of a 2 dimensional array of " $n$ " rows each having equal number of cells. What is the maximum current that can be obtained from this combination.

**(b) This array is connected to an external resistor  $R$ . Derive an expression for the current flowing through  $R$ . For what value of  $R$  is this current maximum.**

**Q.30>** Derive the value of potential due to an electric dipole at a point  $r$  distance away at an angle  $\theta$ . On same graph show the variation of potential with distance for a point charge and for a dipole.

**BY: VINEET PATHAK**

**Sample Paper – 2008**  
**Class – XII**  
**Subject - Physics**

**Assignment**

**Dual nature of radiation and matter**

**Que1** The work function of caesium metal is 2.14eV. When light of frequency  $6 \times 10^{14}$ Hz is incident on the metal surface, photoemission of electrons occurs. What is the:

- (a) maximum kinetic energy of the emitted electrons,
- (b) stopping potential, and
- (c) maximum speed of the emitted photoelectrons?      **Ans = (a) 0.34 eV (b) 0.34V (c) 345.8 kms<sup>-1</sup>**

**Que2** Ultraviolet light of wavelength 2271 Å from a 100 W mercury source irradiates a photo cell made of molybdenum metal. If the stopping potential = 1.3 V, estimate the work function of the metal. How would the photocell respond to a high intensity ( $= 10^5 \text{ Wm}^{-2}$ ) red light of wavelength 6328 Å produced by a He-Ne-laser? **Ans =  $4.74 \times 10^{10}$  Hz**

**Que3** A mercury lamp is a convenient source for studying frequency dependence of photoelectric emission, since it gives a number of spectral lines ranging from the UV to the red end of the visible spectrum. In our experiment with rubidium photo-cell, the following lines from a mercury source were used:  $\lambda_1 = 3650 \text{ Å}$ ,  $\lambda_2 = 4047 \text{ Å}$ ,  $\lambda_3 = 4358 \text{ Å}$ ,  $\lambda_4 = 5461 \text{ Å}$ ,  $\lambda_5 = 6907 \text{ Å}$

The stopping voltages, respectively, were measured to be:

$V_{01} = 1.28 \text{ V}$ ,  $V_{02} = 0.95 \text{ V}$ ,  $V_{03} = 0.74 \text{ V}$ ,  $V_{04} = 0.16 \text{ V}$ ,  $V_{05} = 0 \text{ V}$

- (a) Determine the value of Planck's constant h
- (b) Estimate the threshold frequency and work function for the material

**Ans =  $6.4 \times 10^{-34} \text{ Js}$  (ii)  $5.0 \times 10^{-14} \text{ Hz}$ , 2.00eV**

**Que4** The work function for the following metals is given: Na: 2.75eV; K: 2.30eV; Mo: 4.17eV; Ni: 5.15eV Which of these metals will not give photoelectric emission for a radiation of wavelength 3300 Å from a He-Cd laser placed 1 m away from the photocell? What happens if the laser is brought nearer and placed 50 cm away?

**Que5** Light of intensity  $10^{-5} \text{ Wm}^{-2}$  falls on a sodium photocell of surface area  $2 \text{ cm}^2$ . Assuming that that top 5 layers of sodium absorb the incident energy, estimate the time required for photoelectric emission in the wave picture of radiation. The work function for the metal is given to be about 2eV. What is the implication of your answer?      **Ans = 0.5 year.**

**Que6** In an experiment on photoelectric emission by  $\gamma$ -rays on platinum, the energy distribution of photoelectrons exhibits peaks at a number of discrete energies of K, L and M shells in platinum are known to be 77 keV, 13 keV and 3.5 keV approximately. What is the wavelength of the  $\gamma$ -rays with which the data are consistent?      **Ans =  $3.5 \times 10^{-12} \text{ m}$**

**Que7** An X-ray pulse is sent through a section of Wilson cloud chamber containing a supersaturated gas, and tracks of photoelectrons ejected from the gaseous atoms are observed. Two groups of tracks of lengths 1.40 cm and 2.02 cm are noted. If the range-energy relation for the cloud chamber is given by  $R = \alpha E$  with  $\alpha = 1 \text{ cm/keV}$ , obtain the binding energies of the two levels from which electrons are emitted. (Wavelength of the X-rays pulse =  $4.9 \text{ \AA}$ ) **Ans = 1.13 keV, 0.51 keV**

**Que8** The wavelength of light from the spectral emission line of sodium is 589 nm. Find the kinetic energy at which: (a) an electron, and (b) a neutron, would have the same de Broglie wavelength. **Ans = (a)  $4.34 \mu \text{ eV}$  (b)  $0.236 \text{ neV}$**

**Que9** An electron and a photon each have a wavelength of 1.00 nm. Find (a) their momenta, (b) the energy of the photon, and (c) the kinetic energy of electron. **Ans = (a)  $6.63 \times 10^{-25} \text{ ms}^{-1}$  (b)  $1.24 \text{ keV}$  (c)  $1.51 \text{ eV}$**

**Que10** Crystal diffraction experiments can be performed using X-ray, or electrons accelerated through appropriate voltage. Which probe has greater energy—an X-ray photon or the electron? (For quantitative comparison, take the wavelength of the probe equal to  $1 \text{ \AA}$  which is of the order of interatomic spacing in the lattice) ( $m_e = 9.11 \times 10^{-31} \text{ kg}$ ) **Ans = photon**

**Que11** Obtain the de-Broglie wavelength associated with thermal neutrons at room temperature ( $27^\circ\text{C}$ ). Hence explain why a fast neutron beam needs to be thermalised with the environment before it can be used for neutron diffraction experiments. **Ans =  $1.45 \text{ \AA}$**

**Que12** An electron microscope use electrons accelerated by a voltage of 50kV. Determine the de-Broglie wavelength associated with the electrons. If other factors (such as numerical aperture etc.) are taken to be roughly the same, how does the resolving power of an electron microscope compare with that of an optical microscope which uses yellow light? **Ans =  $5.5 \times 10^{-12} \text{ m}$ , resolving power of electron microscope is about  $10^5$  times optical microscope.**

**Que13** The wavelength of a probe is roughly a measure of the size of a structure that it can probe in some detail. The quark structure of protons and neutrons appears at the minute length scale of  $10^{-15} \text{ m}$  or less. This structure was first probed in early 1970's using high energy electron beams produced by a Linear Accelerator at Stanford, USA. Guess what might have been the order of energy of these electron beams. (Rest mass energy of electron =  $0.511 \text{ MeV}$ ) **Ans =  $1.24 \text{ BeV}$**

**Que14** The extent of localization of a particle is determined roughly by its de Broglie wavelength. If an electron is localized within the nucleus (of size about  $10^{-14} \text{ m}$ ) of an atom, what is its energy? Compare this energy with the typical binding energies (of the order of a few MeV) in a nucleus, and hence argue why electrons cannot reside in a nucleus. **Ans =  $124.3 \text{ MeV}$**

**Que15** Find the typical de Broglie wavelength associated with a He atom in helium gas at room temperature ( $27^\circ\text{C}$ ) and 1 atm pressure; and compare it with the mean separation between two atoms under these conditions. **Ans =  $0.73 \times 10^{-10} \text{ m}$ ,  $3.4 \times 10^{-9} \text{ m}$**

**Que16** Answer the following question:

- (a) Quarks inside protons and neutrons are thought to carry fractional charges  $\left(+\frac{2}{3}e, -\frac{1}{3}e\right)$ .  
 Why do they not show up in Millikan's oil drop experiment?
- (b) Why do we need the oil drops of Millikan's experiment to be of such microscopic sizes?  
 Why cannot we experiment with much bigger drops?
- (c) Stoke's formula for viscous drag is not really valid for oil drops of extremely minute sizes.  
 Why not?
- (d) What is so special about the combination  $e/m$ ? Why do we not simply talk of  $e$  and  $m$  separately?
- (e) Why should gases be insulators at ordinary pressures and start conducting at very low pressures?
- (f) Every metal has a definite work function. Why do photoelectrons not come out all with same energy if incident radiation is monochromatic? Why is there an energy distribution of photoelectrons?
- (g) The energy and momentum of an electron are related to the frequency and wavelength of the associated matter wave by the relation:  $E = h\nu, p = \frac{h}{\lambda}$

But while the value of  $\lambda$  is physically significant, the value of  $\nu$  (and therefore, the value of the phase speed  $v\lambda$ ) has no physical significance. Why?

**Que17** What will happen to: (i) kinetic energy of photoelectrons, and (ii) photocurrent, if the light is changed from ultraviolet to X-ray in a photo-cell experiment? Intensity of the beam is the same in both cases.

**Que18** Define the term 'work function' of a metal. The threshold frequency of a metal is  $f_0$ . When the light of frequency  $2f_0$  is incident on the metal plate, the maximum velocity of electrons emitted is  $v_1$ . When the frequency of the incident radiation is increased to  $5f_0$ , the maximum velocity of electrons emitted is  $v_2$ . Find the ratio of  $v_1$  to  $v_2$ . **Ans = 1:2**

**Que19** State how in a photo-cell, the work function of the metal influence the kinetic energy of emitted electrons.

- (a) If the intensity of incident radiation is doubled, what changes occur in (i) the stopping potential and (ii) the photoelectric current?
- (b) If the frequency of the incident radiation is doubled, what changes occur in the (i) stopping potential and (ii) photoelectric current?

**Que20** If the frequency of the incident radiation on the cathode of a photo-cell is doubled, how will the following change: (i) Kinetic energy of the electrons? (ii) Photoelectric current? (iii) Stopping potential? Justify your answer.

**Que21** Radiation of frequency  $10^{15}$  Hz is incident on three photo-sensitive surfaces A, B and C. Following observations are recorded:

Surface A: No photo-emission occurs.

Surface B: Photo-emission occurs but the photoelectrons have zero kinetic energy.

Surface C: Photo-emission occurs and photo-electrons have some K.E.

Based on Einstein's photo-electric equation, explain the three observations.

**Que22** Radiations of frequency  $10^{15}$  Hz are incident on two photo-sensitive surfaces P and Q. Following observations are made:

- (i) Surface P: Photo-emission occurs but the photo-electrons have zero kinetic energy, and
- (ii) Surface Q: Photo-emission occurs and photo-electrons have some kinetic energy.

Which of these has a higher work function? If the incident frequency is slightly reduced, what will happen to photo-electron emission in the two cases?

**Que23** Red light, however bright, cannot cause emission of electrons from a clean zinc surface, But even weak ultraviolet radiations can do so. Why?

Draw the variation of maximum kinetic energy of emitted electrons with the frequency of incident radiation on a photosensitive surface. On the graph drawn, what do the following indicate (i) slope of the graph and (ii) intercept on energy axis?

**Que 24** On the basis of photon theory, obtain Einstein's photo-electric equation. Use these equations to show that there must exist a threshold frequency for each photo-sensitive surface. Radiations of frequencies  $\nu_1$  and  $\nu_2$  are made to fall in turn, on a photo-sensitive surface. The stopping potentials required for stopping the most energetic emitted photo-electrons in the two cases are  $V_1$  and  $V_2$  respectively. Obtain a formula for determining Planck's constant and the threshold frequency in terms of these parameters

**Que25** An electron,  $\alpha$ -particle and a proton have the same kinetic energy. Which of these particles has the shortest de Broglie wavelength?

**Que26** An  $\alpha$ -particle and a proton are accelerated through the same potential difference. Calculate the ratio of linear momenta acquired by the two.

**Que27** An electron and a proton have the same de Broglie wavelength. Which one of these has higher kinetic energy? Which one is moving faster?

**Que28** The two lines A and B shown in the graph plot the de Broglie wavelength ( $\lambda$ ) as a function of  $1/\sqrt{V}$  ( $V$  is the accelerating potential) for two particles having the same charge. Which of the two represents the particle of heavier mass?

**Que29** An electron and a proton have same wavelength. Which possesses more energy?

### Assignment

#### Atomic Nucleus

**Type - (A) Examples based on Distance of Closest Approach and Impact Parameter**

**Que 1** An  $\alpha$ -particle after passing through a potential difference of  $2 \times 10^6$  V falls on a silver foil. The atomic number of silver is 47. Calculate (i) the kinetic energy of the  $\alpha$ -particle at the time of falling on the foil (ii) the kinetic energy of the  $\alpha$ -particle at a distance of  $5 \times 10^{-14}$  m from the nucleus and (iii) the shortest distance from the nucleus of silver to which the  $\alpha$ -particle reaches.

**Ans =  $6.4 \times 10^{-13}$  J,  $2.1 \times 10^{-13}$  J,  $3.4 \times 10^{-14}$  m**

**Que 2** The number of particles scattered at  $60^\circ$  is 100 per minute in an  $\alpha$ -particle scattering experiment, using gold foil. Calculate the number of particles per minute scattered at  $90^\circ$  angle.



**Ans = 25 particles min<sup>-1</sup>**

**Que 3** Calculate the impact parameter of a 5 MeV particle scattered by 90° when it approaches a gold nucleus. **Ans =  $2.27 \times 10^{-14}$  m**

**Que 4** For scattering by an inverse-square field (such as that produced by a charged nucleus in Rutherford's model) the relation between impact parameter  $b$  and the scattering angle  $\theta$  is given

by  $b = \frac{Ze^2 \cot \theta / 2}{4\pi\epsilon_0 \left( \frac{1}{2}mv^2 \right)}$  (a) What is the scattering angle for  $b = 0$ ? (b) For a given impact

parameter  $b$ , does the angle of deflection increase or decrease with increase in energy? (c) What is the impact parameter at which the scattering angle is 90° for  $Z = 79$  and initial energy equal to 10 MeV? (d) Why is it that the mass of the nucleus does not enter the formula above but its charge does? (e) For a given energy of the projectile, does the scattering angle increase or decrease with decrease in impact parameter?

**Ans =** (a)  $\theta = 180^\circ$  (b)  $\therefore$  As the energy  $\left( \frac{1}{2}mv^2 \right)$  increases, the value of  $\cot \frac{\theta}{2}$

increases and hence the value of scattering angle  $\theta$  decreases, as expected. (c)  $1.1 \times 10^{-14}$  m (d) It is the charge on the nucleus which provides the electrostatic field and due to which scattering of  $\alpha$ -particles occurs. If  $Z = 0$ , then from given formula we have,  $\theta = 0^\circ$ . This means that scattering does not occur when nucleus carries no charge. Mass of nucleus does not appear in the expression for  $b$ , because recoil of the nucleus is being ignored, i.e., the nucleus is assumed

to be at rest during its interaction with the  $\alpha$ -particles. (e) For a given energy  $\left( \frac{1}{2}mv^2 \right)$  of the projectile, the decrease in impact parameter  $b$  implies a decrease in the value of  $\cot \theta/2$  and hence an increase in the scattering angle  $\theta$ .

#### **Type - (B) Examples based on Equivalent Energy, Atomic Mass, Nuclear Size and Nuclear Density**

**Que 5** In a periodic table, the average atomic mass of magnesium is given as 24.312 u. The average value is based on their relative natural abundance on Earth. The three isotopes and their masses are

$^{24}_{12}\text{Mg}$  (23.98504u),  $^{25}_{12}\text{Mg}$  (24.98564),  $^{26}_{12}\text{Mg}$  (25.98259u). The natural abundance of  $^{24}_{12}\text{Mg}$  is 78.99% by

mass. Calculate the abundances of the other two isotopes. **Ans = 9.303%, 11.71%**

**Que 6** The three stable isotopes of neon:  $\text{Ne}^{20}$ ,  $\text{Ne}^{21}$ ,  $\text{Ne}^{22}$  have respective abundances of 90.51%, 0.27% and 9.22%. The atomic masses of the three isotopes are 19.99amu, 20.99amu and 21.99amu respectively. Obtain the average atomic mass of neon. **Ans = 19.45amu**

**Que 7** Obtain approximately the ratio of the nuclear radii of the gold isotope  $^{197}_{79}\text{Au}$  and the silver isotope  $^{107}_{47}\text{Au}$ . What is the approximate ratio of their nuclear mass densities?

**Ans = 1.23, 1**

**Que 8** A nucleus with  $A = 235$  splits into two nuclei whose mass numbers are in the ratio 2:1. If  $R_0 = 1.4$  fm, find the radii of the new nuclei. **Ans = 5.99 fm, 7.55fm**

### Type - (C) Examples bases on Binding Energy of a Nucleus

**Que 9** A given coin has a mass of 3.0g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. For simplicity assume that the coin is entirely made of  $^{63}_{29}\text{Cu}$  atoms (of mass 62.92960amu). The masses of proton and neutron are 1.00783amu and 1.00867amu, respectively.

**Ans =  $1.6 \times 10^{25}$  MeV**

**Que - 10** Obtain the binding energy of the nuclei  $^{56}_{26}\text{Fe}$  and  $^{209}_{83}\text{Bi}$  in units of MeV from the following data :

$$m_H = 1.007825 \text{ amu}, m_n = 1.008665 \text{ amu},$$

$$m(^{56}_{26}\text{Fe}) = 55.934939, m(^{209}_{83}\text{Bi}) = 208.980388 \text{ amu} \quad 1 \text{ amu} = 931.5 \text{ MeV}$$

which nucleus has greater binding energy per nucleon? **Ans = 7.85 MeV**

**Que 11** The neutron separation energy is defined to be the energy required to remove a neutron from a nucleus. Obtain the neutron separation energies of the nuclei  $^{41}_{20}\text{Ca}$  and  $^{27}_{13}\text{Al}$  from the following data:

$$m_n = 1.008665 \text{ amu}; m(^{40}_{20}\text{Ca}) = 39.962591 \text{ amu}$$

$$m(^{41}_{20}\text{Ca}) = 40.962278 \text{ amu}; m(^{26}_{13}\text{Al}) = 25.986895 \text{ amu}, m(^{27}_{13}\text{Al}) = 26.981541 \text{ amu}.$$

**Ans = 8.36 MeV, 13.05 MeV**

**Que 12** The atomic mass of  $^{16}_8\text{O}$  is 16.000000amu. Calculate the binding energy of  $^{16}_8\text{O}$  in MeV per nucleon. **Ans = 7.68 MeV**

### Type (D) Examples based on Radioactivity

**Que 13** Half-life of a certain radioactive material against  $\alpha$ -decay is 138 days. After what lapse of time the undecayed fraction of the material will be 6.25%? **Ans = 552 days**

**Que 14** The half-life, of a given radioactive nuclide, is 138.6 days. What is the mean life of this nuclide? After how much time will a given sample of this radioactive nuclide get reduced to only 12.5% of its initial value? **Ans = 199.58 days, 415.8 days**

**Que 15** A sample contains  $10^{-2}$  kg each of the two substances A and B with half-lives 4 sec and 8 sec respectively. Their atomic weights are in the ratio of 1:2. Find the amounts of A and B after an interval of 16 second. **Ans =  $6.25 \times 10^{-4}$  kg,  $2.5 \times 10^{-3}$  kg**

**Que 16** The half-life of radium is 1500 years. After how many years will one gram of the pure radium (i) reduce to centigram? (ii) lose one milligram? **Ans =  $9.972 \times 10^3$  years (ii) 1.995 years**

**Que 17** The decay constant, for a radionuclide, has a value of  $1.38 \text{ day}^{-1}$ . After how much time will a given sample of this radionuclide get reduced to only 6.25% of its present number? **Ans = 2 days**

**Que 18** The mean lives of a radio-active substance are 1620 years and 405 years for  $\alpha$  - emission and  $\beta$ -emission respectively. Find out the time during which three fourth of a sample will decay if it is decaying both by  $\alpha$  -emission and  $\beta$  -emission simultaneously. ( $\log_e 4 = 1.386$ ) **Ans = 449.1 yr**

**Que 19** A radioactive sample contains 2.2mg of pure  $^{11}_6\text{C}$  which has half life period of 1224 seconds Calculate: (i) the number of atoms present initially. (ii) the activity when 5 $\mu$ g of the sample will be left.

**Ans = (i)  $1.2 \times 10^{20}$  = Number of atoms present initially. (ii)  $1.55 \times 10^{14}$  disintegrations/second**

**Que 20** There is a stream of neutrons with a kinetic energy of 0.0327 eV. If the half-life of neutrons is 700 s, what fraction of neutrons will decay before they travel a distance of 10 km? Mass of neutron =  $1.675 \times 10^{-27}$  kg. **Ans =  $2.5 \times 10^3 \text{ ms}^{-1}$ , 0.004**

**Que 21** Some amount of a radioactive substance (half-life = 10 days) is spread inside a room and consequently the level of radiation becomes 50 times the permissible level for normal occupancy of the room. After how many days the room will be safe for occupation? **Ans = 56.45 days**

**Que 22** A small quantity of solution containing  $\text{Na}^{24}$  radio nuclide (half-life 15 hours) of activity 1.0 microcurie is injected into the blood of a person. A sample of the blood of volume 1  $\text{cm}^3$  taken after 5 hours show an activity of 296 disintegrations per minute. Determine the total volume of blood in the body of the person. (1 curie =  $3.7 \times 10^{10}$  disintegrations per second) **Ans = 6 litres**

**Que 23** The nucleus  ${}_{92}^{238}\text{U}$  is unstable against  $\alpha$ -decay with a half-life of about  $4.5 \times 10^9$  years. Write down the equation of the decay and estimate the kinetic energy of the emitted  $\alpha$ -particle from the following data:  $m({}_{92}^{238}\text{U}) = 238.0581 \text{ amu}$ ,  $m({}_2^4\text{He}) = 4.00260 \text{ amu}$ ,  $m({}_{90}^{234}\text{Th}) = 234.04363 \text{ amu}$ . **Ans = 4.26 MeV.**

**Que 24** The nucleus  $\text{Ne}^{23}$  decays by  $\beta$ -emission. Write down the  $\beta$ -decay equation and determine the maximum kinetic energy of the electrons emitted from the following data:

$$m({}_{10}^{23}\text{Ne}) = 22.994466 \text{ amu}, m({}_{11}^{23}\text{Ne}) = 22.989770 \text{ amu}. \text{Ans} = 4.374 \text{ MeV}$$

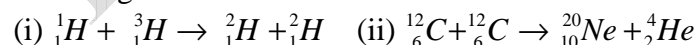
**Que 25** Obtain the maximum kinetic energy of  $\beta$ -particles and the radiation frequencies corresponding to  $\gamma$ -decays in the decay scheme shown in Fig. You are given that,  $m(\text{Au}^{198}) = 197.968233 \text{ amu}$ ,  $m(\text{Hg}^{198}) = 197.966760 \text{ amu}$  **Ans = 0.960 MeV**

### **Type - (E) Examples Based on (i) Q-value (ii) Nuclear Fission (iii) Nuclear Fusion**

**Que 26** The Q value of a nuclear reaction  $A + b \rightarrow C + d$  is defined by

$$Q = [m_A + m_b - m_c - m_d] c^2$$

Where the masses refer to nuclear rest masses. Determine from the given data whether the following reactions are exothermic or endothermic.



Atomic masses are given to be :

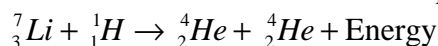
$$m({}_1^1\text{H}) = 1.007825 \text{ amu}, \quad m({}_1^2\text{H}) = 2.014102 \text{ amu} \quad \text{Ans} = 4.618 \text{ MeV}$$

$$m({}_1^3\text{H}) = 3.016049 \text{ amu}, \quad m({}_6^{12}\text{C}) = 12.000000 \text{ amu}$$

$$m({}_{10}^{20}\text{Ne}) = 19.992439 \text{ amu} \quad m({}_2^4\text{He}) = 4.002603 \text{ amu}$$



**Que 27** The bombardment of lithium with protons gives rise to the following reaction:



The atomic masses of lithium, hydrogen and helium are 7.016amu, 1.008amu and 4.004amu respectively. Find the initial energy of each  $\alpha$  - particle (1amu = 931 MeV) **Ans = 7.448 MeV**

**Que 28** Calculate the disintegration energy Q for the fission of  ${}^{98}_{42}\text{Mo}$  into two equal fragments,  ${}^{49}_{21}\text{Sc}$ . If Q turns out to be positive, explain why this process does not occur spontaneously.

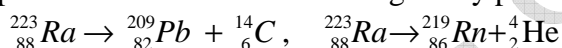
Given that:

$$m({}^{98}_{42}\text{Mo}) = 97.90541 \text{ amu}, \quad m({}^{49}_{21}\text{Sc}) = 48.95002 \text{ amu}, \quad m_n = 1.00867 \text{ amu. Ans = 944.6 MeV}$$

**Que 29** What is the power output of  ${}^{235}_{92}\text{U}$  reactor if it takes 30 days to use up 2 kg of fuel and if each fission gives 185 MeV of usable energy? **Ans = 58.5 MW.**

**Que 30** A 1000 MW fission reactor consumes half of its fuel in 5.00y. How much  ${}^{235}_{92}\text{U}$  did it contain initially? Assume that all the energy generated arises from the fission of  ${}^{235}_{92}\text{U}$  and that this nuclide is consumed by the fission process. **Ans = 3860 kg.**

**Que 31** Under certain circumstances, a nucleus can decay by emitting a particle more massive than an  $\alpha$ -particle. Consider the following decay processes:



- Calculate the Q values for these decays and determine that both are energetically possible.
- The Coulomb barrier height for alpha-particle emission is 30.0 MeV. What is the barrier height for  ${}^{14}_6\text{C}$ ? The required data is

$$m({}^{223}_{88}\text{Ra}) = 223.01850 \text{ amu}, \quad m({}^{209}_{82}\text{Pb}) = 208.98107 \text{ amu}$$

$$m({}^{219}_{86}\text{Rn}) = 219.00948 \text{ amu}, \quad m({}^{14}_6\text{C}) = 14.00324, \quad m({}^4_2\text{He}) = 4.00260 \text{ amu}$$

**Ans = 31.85 MeV, 5.98 MeV (b) 81.09 = 81 MeV**

**Que 32** Calculate and compare the energy released by (a) fusion of 1.0 kg of hydrogen deep within the Sun and (b) the fission of 1.0 kg of  ${}^{235}\text{U}$  in a fission reactor. **Ans =  $39 \times 10^{26}$  MeV (ii)  $5.1 \times 10^{26}$  MeV**

**Que 33** Two protons, each having a kinetic energy K, are fired at each other. What must K be if the particles are brought to rest by their mutual coulomb repulsion? Assume a proton to be a sphere of radius  $R = 1 \text{ fm}$ . Also estimate the temperature at which the protons can overcome this energy barrier. **Ans = 400 keV,  $3 \times 10^9 \text{ K}$ .**

**Que 34** It is proposed to use the nuclear reaction:  ${}^2_1\text{H} + {}^2_1\text{H} \rightarrow {}^4_2\text{He}$

in a nuclear reactor of 200 MW rating. If the energy from the above reaction is used with a 25% efficiency in the reactor, how many grams of deuterium fuel will be needed per day? The masses of  ${}^2_1\text{H}$  and  ${}^4_2\text{He}$  are 2.0141amu and 4.0026amu respectively. **Ans = 121.3 g**

**Que 35** The radioactivity of the sample is  $R_1$  at time  $t_1$  and  $R_2$  at time  $t_2$ . The mean life of the sample is  $\tau$ . What is the number of nuclei that have disintegrated in the time interval  $(t_1 - t_2)$ ?

**Ans** =  $\therefore R_1 - R_2 = \lambda(N_1 - N_2)$  or  $N_1 - N_2 = \frac{R_1 - R_2}{\lambda}$  Clearly,  $(N_1 - N_2)$  is the number of nuclei that have disintegrated in time interval  $(t_1 - t_2)$

**Que36** You are given two nuclides  ${}^7_3X$  and  ${}^4_3Y$  (i) Are they the isotopes of the same element? Why? (ii) Which one of the two is likely to be more stable? Give reason.

**Que37**  $M_1$  and  $M_2$  represent the masses of  ${}^{20}_{10}Ne$  nucleus and  ${}^{40}_{20}Ca$  nucleus respectively. State, whether  $M_1 = 2M_2$  or  $M_2 > 2M_1$  or  $M_2 < 2M_1$ ?

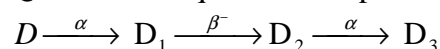
**Que38** Group the following six nuclides into three pairs of (i) isotones, (ii) isotopes and (iii) isobars:

${}^{12}_6C$ ,  ${}^3_2He$ ,  ${}^{198}_{80}Hg$ ,  ${}^3_1H$ ,  ${}^{197}_{79}Au$ ,  ${}^{14}_6C$  How does the size of a nucleus depend on its mass number?

Hence explain why the density of nuclear matter should be independent of the size of the nucleus.

**Que39** Define decay constant of a radioactive sample. Which of the following radiations,  $\alpha$ -rays,  $\beta$ -rays,  $\gamma$ -rays (i) are similar to X-ray? (ii) are easily absorbed by matter? (iii) travel with greatest speed? (iv) are similar in nature to cathode rays?

**Que40** The sequence of stepwise decays of a radioactive nucleus is



If the nucleon number and atomic number of  $D_2$  are 176 and 71 respectively, what are the corresponding values of  $D$  and  $D_3$ ? Justify your answer in each case.

**Que41** (a) If the  $\alpha$ -decay of  ${}^{238}_{92}U$  is energetically allowed (i.e., the decay products have a total mass less than the mass of  ${}^{238}_{92}U$ ), what prevents  ${}^{238}_{92}U$  from decaying all at once? Why is its half life so large? (b) The  $\alpha$ -particle faces a Coulomb barrier. A neutron being uncharged faces no such barrier. Why does the nucleus  ${}^{238}_{92}U$  not decay spontaneously by emitting a neutron?

**Que42** (a) The observed decay products of a free neutron are a proton and an electron. The emitted electrons are found to have a continuous distribution of kinetic energy with a maximum of  $(m_n - m_p - m_e) C^2$ . Explain clearly why the presence of a continuous distribution of energy is a pointer to the existence of other unobserved product (s) in the decay.

(a) If a neutron is unstable with a half life of about 1000s, why don't all the neutrons of a nucleus decay eventually into protons? How can a nucleus of  $Z$  protons and  $(A-Z)$  neutrons ever remain stable if the neutrons themselves are unstable?

**Que43** Give the mass number and atomic number of elements on the right-hand side of the decay process.  ${}^{220}_{86}Ru \rightarrow Po + He$ . The graph shows how the activity of a sample of radon-220 changes with time. Use the graph to determine its half-life. Calculate the value of decay constant of radon-220

**Que44** The isotope of uranium  ${}^{238}_{92}U$  decays successively to

form  ${}^{234}_{90}Th$ ,  ${}^{234}_{92}Pa$ ,  ${}^{234}_{92}U$ ,  ${}^{234}_{90}Th$ ,  ${}^{226}_{88}Ra$  and  ${}^{222}_{86}Rn$ . What are the radiations emitted in each decay process?

**Sample Paper -2008**  
**Class - XII**  
**Subject - Physics**

**Time allowed : 3 hours**

**Maximum Marks : 70**

**General Instructions :**

- (i) All questions are compulsory.
- (ii) **This paper includes questions from chapters nine to fifteen only**
- (iii) Question numbers **1 to 8** are very short answer type questions, carrying **one** mark each.
- (iv) Question numbers **9 to 18** are short answer type questions, carrying **two** marks each.
- (v) Question numbers **19 to 27** are also short answer type questions, carrying **three** marks each.
- (vi) Question numbers **28 to 30** are long answer type questions, carrying **five** marks each.
- (vii) Use of calculators is not permitted. However, you may use log tables, if necessary.

**Q.1>** Define “bandwidth” of a signal

**Q.2>** In a series of radioactive disintegration of  ${}^Z\text{X}_A$ , first an alpha particle and then a beta particle is emitted. What is the atomic and mass number of the new nucleus formed by this disintegration.

**Q.3>** Mention one advantage of reflecting type telescope

**Q.4>** With that purpose was famous Davisson-Germer experiment with electrons performed?

**Q.5>** What should be the length of the dipole antenna for a carrier wave of frequency  $3 \times 10^8 \text{ Hz}$  ?

**Q.6>** Why is heavy water used as a moderator in a nuclear reactor?

**Q.7>** What is the name given to that part of electromagnetic spectrum which is used for taking photographs of earth under foggy conditions from great heights?

**Q.8>** Draw the symbol of the universal logic gate.

**Q.9>** What is the frequency of the output if 50Hz input is applied to a (a) H.W. rectifier  
(b) F.W. Rectifier

**Q.10>** Give reasons for  
(a) The sky appears blue  
(b) Sun appears reddish at sunset and sunrise

**Q.11>** Draw energy band diagrams of p type and n type semiconductors

**Q.12>** State the two drawbacks of Bohr's theory.

**Q.13>** Draw a labeled block diagram for a communication system

**Q.14>** An equi-concave lens of radius 10cm is made of a material having refractive index 1.5. Find the focal length of this lens when it is kept in water ( refractive index  $\frac{4}{3}$  )

**Q.15>** An electron, an alpha particle and a proton have the same kinetic energy. Which of these will have the largest De'Broglie wavelength

**Q.16>** The two slits in YDSE are separated by 0.03mm and the screen is kept 1.5m away. The 4<sup>th</sup> bright fringe is at a distance of 1cm from the central maxima. Calculate the wavelength of light used.

**Q.17>** An astronomical telescope consist of 2 thin lenses 36cm apart and has a magnifying power of 8. Calculate the focal length of the lenses.

**Q.18>** Find the wavelength of the first and the last spectral line of balmer series.

OR

An electron makes a transition from 4<sup>th</sup> shell to the 1<sup>st</sup> shell. Find the wavelength of light emitted. To which spectral series does this transition belong?

**Q.19>** Draw the binding energy curve. What are the 2 main inferences of this curve?

**Q.20>** Show that the decay rate 'R' of a sample of a radionuclide is related to the number of radioactive nuclei 'N' at the same instant by the expression  $R = \lambda N$ .

(b) The half-life of  $^{238}\text{U}_{92}$  against  $\alpha$ -decay is  $1.5 \times 10^{17}$  s. What is the activity of a sample of  $\text{U}^{238}$  having  $25 \times 10^{20}$  atoms?

**Q.21>** Calculate the De'Broglie wavelength of (a) an electron in hydrogen atom moving with 0.01 times the speed of light and (b) a ball of radius 1cm and mass 0.3 kg moving with a speed of 5m/s. Hence show that the wave nature of matter is important at the atomic level but is not really relevant at the macroscopic level.

**Q.22>** Explain briefly, with the help of circuit diagram, how V—I characteristics of a p-n junction diode are obtained in (i) forward bias, and (ii) reverse bias. Draw the shape of the curves obtained.

**OR**

Distinguish between metals, insulators and semiconductors on the basis of their energy bands. Draw a graph showing the variation of resistivity of conductors and semiconductors with temp.

**Q.23>** Draw a circuit diagram for use of npn transistor as an amplifier in common emitter configuration. The input resistance of a transistor is 1000ohm. On changing its base current by 10microampere, the collector current increases by 2 m A. If a load resistance of 5K ohm is used in the circuit, calculate:

- (i) The current gain
- (ii) Voltage gain of the amplifier

**Q.24>** Define the term modulation. Name three different types of modulation used for a message signal using a sinusoidal continuous carrier wave. Explain the meaning of any one of these.

**Q.25>** State and derive Snell's law using wave theory.

**Q.26>** A material has a work function of 1.5 eV. Light of wavelength 310nm is incident on it. Find

- (a) Kinetic energy of the emitted photo-electron
- (b) Threshold wavelength
- (c) Stopping potential

**Q.27>** State Bohr's postulate for the 'permitted orbits' for the electron in a hydrogen atom. Use this postulate to prove that the circumference of the nth permitted orbit for the electron can 'contain' exactly n wavelengths of the De'Broglie wavelength associated with the electron in that orbit.

**Q.28>** What is binding energy. How is it related to mass defect?

The nucleus of an atom of  $^{235}_{92}\text{Y}$ , initially at rest, decays by emitting an alpha-particle as per the equation  $^{235}_{92}\text{Y} \rightarrow ^{231}_{90}\text{X} + ^4_2\text{He} + \text{Energy}$

It is given that the binding energies per nucleon of the parent and the daughter nuclei are 7.8 MeV and 7.835 MeV respectively and that of alpha-particle is 7.07MeV/nucleon.

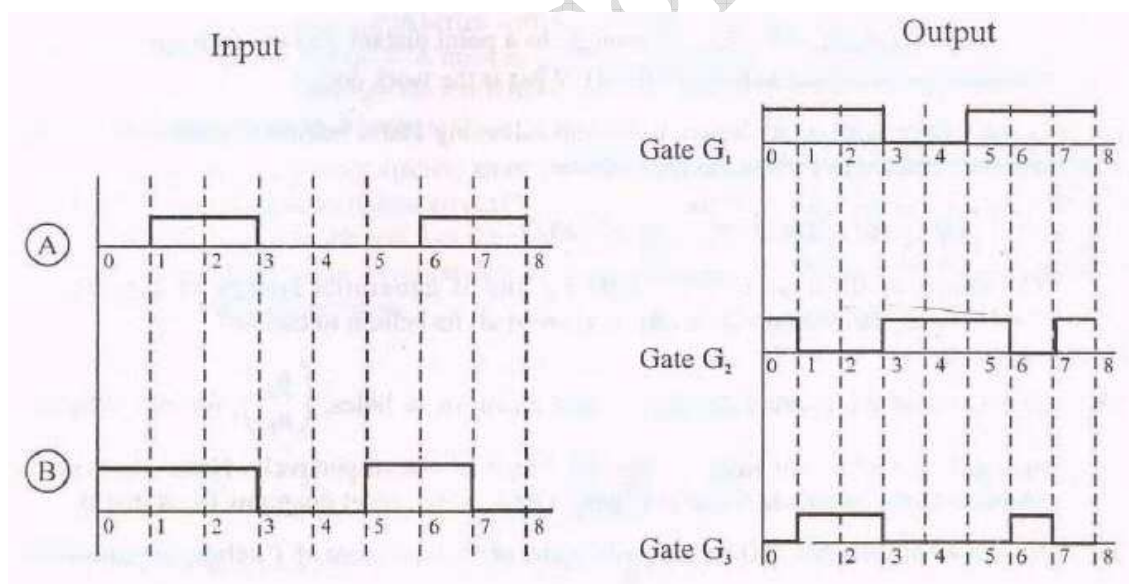
Assuming the daughter nucleus to be formed in the unexcited state and neglecting its share in the energy of the reaction, calculate the speed of the emitted alpha-particle. Take mass of alpha-particle to be  $6.68 \times 10^{-27}$  kg.

**Q.29>** Derive the relation b/w distance of object, image and radius of curvature of a convex spherical surface when refraction takes place from rarer medium to a denser medium and image produced is real. State assumptions and conventions of sign used.

OR

Using suitable ray diagrams, explain the following defects and their corrections

- Short sightedness
- Far sightedness
- presbyopia
- astigmatism



**Q.30>** Two signals A and B as shown are used one by one as the two inputs of the three gates G<sub>1</sub>, G<sub>2</sub> and G<sub>3</sub>. The outputs obtained from the three gates are as shown. Identify each of the three gates

Which of them is called the universal gate. Explain using a figure, how a combination of suitable number of this gate can be used to get the other 2 gates.



**Sample Paper- 2008**  
**Class - XII**  
**Subject - Physics**

**Time : Three Hours**  
**Max.Marks: 70**

**General Instructions**

- (a) All questions are compulsory.
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- (d) Use of calculators is not permitted.
- (e) You may use the following physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4 \pi \times 10^{-7} \text{ TmA}^{-1}$$

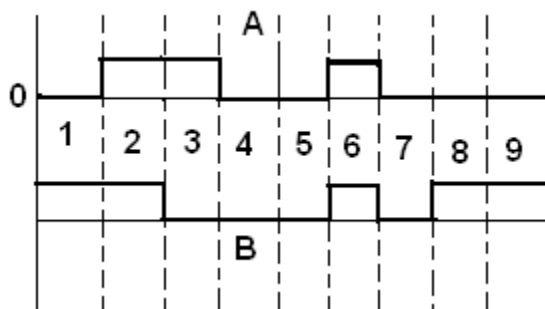
$$\text{Boltzmann constant } k = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

$$\text{Avogadro's number } N_A = 6.023 \times 10^{23} / \text{mole}$$

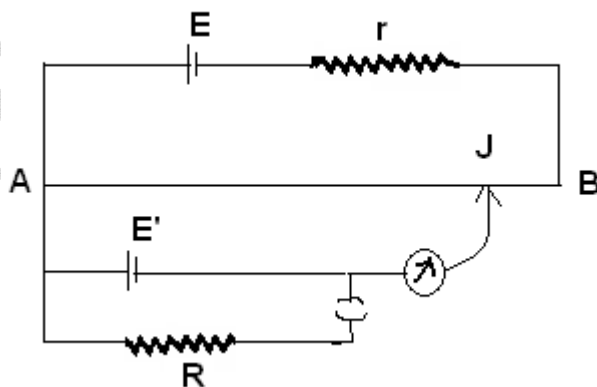
$$\text{Mass of neutron } m_n = 1.6 \times 10^{-27} \text{ kg}$$

1. State two properties of the material of the wire used for suspension of the coil in a moving coil Galvanometer.
2. Why does the acceleration of a magnet falling through a long solenoid decrease?
3. How does electric resistance differ from reactance?
4. What evidence is there to show that sound is not electromagnetic wave?
5. Vehicles moving in foggy weather use yellow color headlights. Why?
6. Draw the graph showing the distribution of kinetic energy of electrons emitted during beta decay.
7. What is the phase relation between input signal and output signal in the case of transistor amplifier in a) common emitter configuration b) common base configuration?

8. The signals A and B are used as two inputs of NOR gate. Sketch the output wave form. Draw its logic symbol.



9. Two point charges  $q_A = +3\mu\text{C}$  and  $q_B = -3\mu\text{C}$  are located 20 cm apart in vacuum.
- Find the electric field at the mid point of the line (AB) joining the two charges.
  - If a negative test charge of magnitude  $1.5 \times 10^{-9} \text{ C}$  is placed at the centre, find the force experienced by the test charge.
10. When a battery of e.m.f  $E$  and internal resistance  $r$  is connected to a resistance  $R$ , a current  $I$  flows through it. Derive a relation between  $E$ ,  $I$ ,  $r$  and  $R$ .
11. Draw a graph to show the variation of stopping with frequency of radiations incident on a metal plate. How can the value of Plank's constant be determined from this graph?
12. The following circuit shows the use of potentiometer to measure the internal resistance of a cell.



13. State four properties of electromagnetic waves.



14. How do optical fibers transmit light without significant absorption? Mention one practical application of optical fibres.

Or

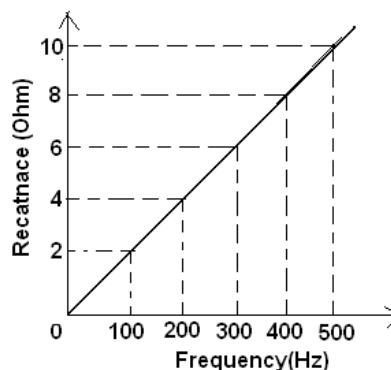
- What is the effect of increasing the diameter of the objective of a telescope on its  
i) magnifying power and ii) resolving power.

15. Monochromatic light incident on a metal surface emits electron with kinetic energies from 0 to 2.6 eV. What is the least energy of incident photon if the tightly bound electron needs 4.2 eV to be removed?
16. For a given impact parameter  $b$ , does the angle of deflection increase or decrease with increase in energy?
17. Why do we use short waves for long distance radio broadcast?
18. Derive an expression for the potential and kinetic energy of an electron in any orbit of a hydrogen atom, according to Bohr's atomic model. How does P.E change with increasing  $n$ ?
19. Mention the frequency at which T.V signals are transferred. Derive an expression for the range up to which signals transmitted by a T.V tower can be received.

Or

Give point of difference between conductor, semiconductor and insulator on the basis of energy band theory.

20. A slit of width ' $d$ ' is illuminated by light of wavelength  $6500 \text{ \AA}$ . For what values of ' $d$ ' will the i) first minimum fall at an angle of diffraction of  $30^\circ$  ii) First maximum fall at an angle of diffraction of  $30^\circ$ .
21. Explain the principle, construction and working of a Van de Graff generator.
22. Fig shows, how the reactance of an inductor varies with frequency  
i) Calculate the value of the inductance of the inductor using the information given in the graph.  
ii) If the inductor is connected in series to a resistor of 8 ohm, find what would be the impedance at 300 Hz.



23. Draw a ray diagram to show an image id formed by a compound microscope. On what factors will depend i) its resolving power, and ii) its magnifying power?
24. Prove that an ideal inductor does not dissipate power in an a.c circuit.

Or

25. Half life of a certain radioactive material against  $\alpha$  –decay is 138 days. After what lapse of time the undecayed fraction of the material will be 6.25 %.
26. State Gauss' theorem. Express it mathematically. Apply this theorem to obtain an expression for electric field due to straight wire carrying a positive charge.
27. What is the principle of a potentiometer? How can it be used for comparing emf's of two primary cells? Why cannot we use a voltmeter for the same purpose?
28. a) Draw the energy band diagram of an n-type semiconductor. How does the forbidden energy gap of an intrinsic semiconductor vary with increase in temperature?
- b) A transistor is connected in common-emitter configuration in which collector supply is 8V and the voltage across. The  $800\ \Omega$  resistor in the collector circuit is 0.5 V. If  $\alpha = 0.96$ , determine the a) collector emitter voltage b) base current.

Or

- Explain with the help of a labeled circuit diagram the use of a transistor as an oscillator.
29. Derive the lens-maker's formula in case of a double convex lens. State the assumptions made and convention of signs used.

Or

- State the condition under which the phenomenon of diffraction of light takes place. Derive an expression for the width of the central maximum due to diffraction of light at a single slit.
30. Give principle, construction and working of moving coil galvanometer.

Or

- Explain the phenomenon of total internal reflection. State two conditions that must be satisfied for total internal reflection to takes place. Derive the relation between the critical angle and the refractive index of the medium. Draw ray diagrams to show a right angled isosceles prism can be used to i) deviate ray through  $180^\circ$ , and ii) to invert it.

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**Sample Paper - 2008**  
**Subject – Physics**  
**CLASS – XII**

**Time: Three Hours**

**Max. Marks: 70**

**General Instructions**

- (a) All questions are compulsory.
- (b) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.
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$$h = 6.6 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4 \pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\text{Boltzmann constant } k = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

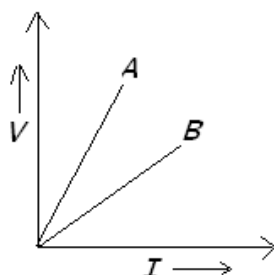
$$\text{Avogadro's number } N_A = 6.023 \times 10^{23} / \text{mole}$$

$$\text{Mass of neutron } m_n = 1.6 \times 10^{-27} \text{ kg}$$

$$1 \text{ MeV} = 1.602 \times 10^{-13} \text{ J}$$

1. What is the change in the collector current in a transistor of a.c current gain 150, for a  $100 \mu\text{A}$  change in the base current?
2. What is Bohr's frequency condition?
3. What is de-Broglie wavelength of an atom at absolute temperature  $T$  K.
4. In a single slit diffraction experiment, the width of the slit is halved. How does it affect the size and intensity of the central maximum?
5. What is the nature of waves used in radar? What is their wavelength range?
6. A metal foil is placed in the middle of a parallel plate capacitor? What is the effect on the capacitance of the system?
7. Why a cyclotron is not suitable to accelerate electrons?
8. How does the quality factor ( $Q$ ) signifies in an LCR A.C circuit?
9. Two point charges  $4\mu\text{C}$  and  $-2\mu\text{C}$  are separated by a distance of 1 m in air. At what point on the line joining the charges is the electric potential zero?

10. An air-core solenoid is connected to an a.c source and a bulb. If an iron-core is inserted in the solenoid, how does the brightness of a bulb change? Give reasons
11. V-I graph for parallel and series combinations of two metallic resistors are as shown in the fig. which graph shows parallel combination? Justify?



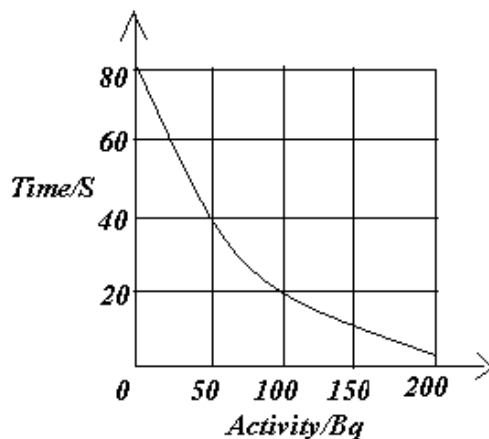
12. Using Gauss's theorem, prove that charges reside entirely on the outer surface of an insulated conductor.
13. Prove that two parallel conductors carrying current in the opposite directions repel each other.
14. Derive expression for the mutual inductance of a pair of co-axial solenoids having number of turns  $N_1$  and  $N_2$ .
15. Arrange the following in ascending order of wavelength; X rays, Microwaves, Radio waves, UV rays. Give any two uses of these radiations.

Or

Write three characteristics of electromagnetic waves. Which part of the electromagnetic waves has highest frequency?

16. The ratio of the intensities at minima to maxima in the interference pattern is 9:25. What will be the ratio of the widths of the two slits in the young's double slit experiment.
17. What is ground wave? Why short wave communication over long distance is not possible via ground waves

18. The graph shows how the activity of a radioactive material changes with time. Using the graph, determine i) Half-life of the material and ii) decay constant.



19. A parallel plate capacitor is charged to a potential difference  $V$  by a d.c source. The capacitor is then disconnected from the source. If the distance between the plates is doubled, state with reasons, how the following will change.
- Electric field between the plates
  - Capacitance of the capacitor and
  - Energy stored in the capacitor.
20. The input resistance of a silicon transistor is  $665 \Omega$ . Its base current is changed by  $15 \mu A$  which results in a change of collector current by  $2 mA$ . The transistor is used as a common emitter amplifier with a load resistance of  $5 k\Omega$ . Calculate i) current gain  $\beta_{ac}$  ii) transconductance  $g_m$  and iii) voltage gain  $A_v$  of the amplifier.
21. When an alternating voltage of  $220 V$  is applied across a device X, a current of  $0.5 A$  flows through it and is in phase with the applied voltage. When the same voltage is applied across another device Y, the same current flows again through Y but it leads the applied voltage by  $\pi/2$  radians.
- Name the devices X and Y
  - Calculate the current flowing in the circuit when same voltage is applied across the series combination of X and Y

Or

Give any three energy losses in a transformer. Give one method in each to reduce the same.

22. How will the magnifying power of a refracting astronomical telescope be affected on increasing for its eye-piece i) the focal length and ii) aperture? Justify your answer.
23. Explain the following phenomena;  
 i) Sun looks reddish at sunrise and sunset.  
 ii) Two independent source of light can not produce interference fringes?  
 iii) A fish in water appears to be higher than actually it is.
24. What are isotopes? Which of the following radiations  $\alpha$  rays,  $\beta$  rays and  $\gamma$  rays.  
 a) are similar to X rays.  
 b) are easily absorbed by matter  
 c) travel with greatest speed  
 d) are similar in nature to cathode rays  
 e) can ionize most.
25. What is a rectifier? Explain full wave rectification with a neat circuit diagram. Draw input and output graphs also.
26. Show that the de- Broglie wavelength of electron of energy  $E$  is given by the relation
- $$\lambda = \frac{h}{\sqrt{2mE}}$$
27. a) Why TV signals cannot be propagated by a sky wave? How can you increase the range of TV signals?  
 b) If the frequency of a plane electromagnetic wave is 60 MHz , what is the wavelength of the wave.
28. Four double convex lens of the following specifications are available:  
 Which two of the given four lenses should be selected as the objective and eye-piece to construct a compound microscope and why? How can the magnifying power of such a microscope can be increased?

Lens	Focal length	Aperture
A	100 cm	10 cm
B	100 cm	5 cm
C	10 cm	2 cm
D	5 cm	2 cm

Or

Obtain Lens Makers formula in case of a double convex lens. State the assumptions and conventions of signs used.

29. Define resistivity of a conductor .How does it vary with temperature? A wire of uniform cross-section and length  $l$  has a resistance of  $16 \Omega$ . It is cut in to four equal parts. Each part is stretched uniformly to the length  $l$  and all the four

stretched parts are connected in parallel. Calculate the total resistance of the combination so formed. Assume that the stretching of wire does not cause any change in the density of its material.

Or

Explain with the help of a circuit diagram, the use of potentiometer for determination of internal resistance of a primary cell. Derive necessary mathematical expression?

30. Explain the principle and working of a cyclotron with the help of a labelled diagram. A cyclotron oscillator frequency is 10 MHz. What should be the operating magnetic field for accelerating protons? If the radius of its Dees is 60 cm, what is the kinetic energy of the proton beam produced by the accelerator? Express your answer in units of MeV

Or

State Ampere's circuital law. Use this law to find the expression for magnetic field produced by a long straight solid conductor of radius 'a' and carrying a current I at a distance r from the axis of the conductor in the region

i)  $r < a$   
ii)  $r > a$

**SAMPLE PAPER – 2008**

**Class – XII**

**Subject - Physics**

***Time allowed : 3 hours***

***Maximum Marks : 70***

***General Instructions :***

- (i) *All questions are compulsory.*
- (ii) ***This paper includes questions from chapters one to eight only***
- (iii) *Question numbers 1 to 8 are very short answer type questions, carrying **one** mark each.*
- (iv) *Question numbers 9 to 18 are short answer type questions , carrying **two** marks each.*
- (v) *Question numbers 19 to 27 are also short answer type questions, carrying **three** marks each.*
- (vi) *Question numbers 28 to 30 are long answer type questions, carrying **five** marks each.*
- (vii) *Use of calculators is not permitted. However, you may use log tables, if necessary.*

Q.1> Name two electromagnetic waves that are emitted by an incandescent bulb.

Q.2 > Name the physical quantity whose SI unit is (a) Coulomb per Volt (b) Volt meter



Q.3> A student obtains resistances of 3, 4, 12 and 16 ohms using only two metallic resistance wires either separately or joined together. What is the value of resistance of each of these wires.

Q.4> Mention one advantage and one disadvantage of AC over DC

Q.5> In a certain arrangement a proton does not get deflected while passing through a magnetic field region. Under what conditions is it possible?

Q.6> Lorentz force is given by  $F = Q (V \times B)$ . Of these, name the pairs of vectors which are always at right angles to each other.

Q.7> Mention 2 properties of alloys from which permanent magnets are made

Q.8> An alpha particle and a proton are accelerated by the same potential difference. Calculate the ratio of linear momenta acquired by the two.

Q.9> Define "Intensity of Electric field" at a point. At what points is the electric dipole field intensity parallel to the line joining the charges?

Q.10> Capacitor P, Q and R each have a capacitance C. A battery can charge the capacitor P to a potential V. If after charging P, the battery is disconnected from it and the charged capacitor P is connected in following separate instances to Q and R

(a) In parallel to Q and

(b) In series to R,

Then, what will be the potential difference across P?

Q.11> An inductor of 2mH carries a current of 5A. The direction of current is reversed in it in half a second due to which a voltage is produced across the inductor. What is this phenomenon known as? Find the voltage produced.

Q.12> Why is conductivity of electrolytes less than that of metals?

Q.13> A matrix of  $N \times M$  cells each of emf E and internal resistance r is connected to an external resistor R. Write an expression for the current flowing in R. Under what condition will this current be maximum.

Q.14> "N" identical cells each of emf E and internal resistance r are connected in series to an external resistor R. Find the internal resistance r in terms of the current I flowing in the circuit.

(c) How does the internal resistance vary with temp?

Q.15> A metal wire is stretched to increase its length by 10%. What is the percentage change in its resistance? Will the resistivity of the wire change?

Q.16> Plot a graph to show how the following quantities vary with the frequency of the source. (a) Resistance (b) Capacitive reactance (c) Inductive reactance

Q.17> 2 protons A and B are placed in the space b/w a parallel plate capacitor. "A" is placed closer to the left plate while "B" is placed exactly in the center. Which of them will experience a greater force? Give reasons.

Q.18> An armature coil consists of 20 turns of wire, each of area  $A = 0.09\text{m}^2$  and total resistance  $15.0\ \Omega$ . It rotates in a magnetic field of  $0.5\text{T}$  at a constant frequency of  $150/\pi\text{ Hz}$ . Calculate the value of (i) maximum (ii) average induced emf produced in the coil

Q.19> Two point charges  $Q$  and  $2Q$  are kept  $D$  distance apart. A third charge  $X$  is to be kept on the line joining them in such a way that the net force on  $Q$  and  $2Q$  is zero. Calculate the position of  $X$  in terms of  $Q$  and  $D$

Q.20> A  $100\Omega$  Resistor and a  $200\Omega$  resistor are connected in series across an  $84\text{ volt}$  cell. The potential difference across  $100\Omega$  is found using a  $400\Omega$  Voltmeter. What will be the voltmeter reading. What will be the potential difference across  $100\Omega$  if measured with a potentiometer.

Q.21> What are the 3 magnetic elements of Earth.

(b) At a place the vertical and horizontal components of earth's magnetic field are equal to  $20\text{G}$  each. What is the net magnetic field and the angle of dip at this place?

Q.22> A wire of uniform cross section and length  $L$  has a resistance of  $16\Omega$ . It is cut into four equal parts. Each part is stretched uniformly to length  $L$  and all the four stretched parts are connected in parallel. Calculate the total resistance of the combination so formed.

Q.23> Write four characteristics of EM waves. Give 2 uses of (a) Micro waves (b) X rays.

Q.24> State Gauss theorem. Use it to derive the Electric field intensity due to a plane sheet of charge.

Q.25> Why is a potentiometer preferred over a voltmeter to measure the emf of a cell? How can a potentiometer be made more sensitive?

Q.26> Derive the force b/w 2 infinite long parallel straight wires carrying current in the same direction. Hence define one ampere.

Q.27> A potential difference  $V$  is applied across a conductor of length  $L$  and diameter  $D$ . How are the electric field and the resistance  $R$  of the conductor affected when in turn

- (a)  $V$  is halved      (b)  $L$  is halved      (c)  $D$  is doubled

Q.28> State Biot-Savart Law. Use it to obtain the magnetic field at an axial point distanced  $z$  from the center of a circular coil of radius ' $a$ ', carrying a current  $I$ . Hence compare the magnitudes of the magnetic field of this coil at its center and at an axial point for which  $z = \sqrt{3} a$ .

Q.29> When an inductor  $L$  and a resistance  $R$  in series are connected across a 12 V , 50Hz ac source, a current of 0.5A flows in the circuit. The current differs in phase from applied voltage by  $\pi/3$  radian. Calculate the value of  $R$ .

(b) A capacitor and a bulb are connected in series to an ac source. Explain, how the brightness of the bulb will change when

- (a) Distance b/w the plates of the capacitor is increased  
(b) A dielectric slab is introduced in the capacitor

Q.30> A parallel plate capacitor of plate area  $A$  and separation  $d$  is charged to a potential  $V$ . The battery is then disconnected and a dielectric slab of thickness  $d$  and dielectric constant  $K$  is inserted in the capacitor. What change, if any, will take place in

- (a) Charge on the plates      (d) Voltage across the capacitor  
(b) Electric field b/w the plates      (e) Capacitance of the capacitor  
(c) Energy stored

Sample Paper – 2008

**Class – Physics**

**Class – XII**

**Dual nature of matter**

Q.1. State the dependence of work function on kinetic energy of electrons emitted in a photocell. If the intensity of incident radiation is doubled, what changes occur in the stopping potential and photoelectric current?

Q.2. How does the maximum kinetic energy of the emitted electrons vary with the work function?

Q.3. the frequency of incident radiation is greater than the threshold frequency in a photocell. How will the stopping potential vary if frequency is increased, keeping other factors constant.

Q.4. Why are De-Broglie waves associated with a moving football not visible. The wavelength of a photon and De-Broglie wavelength of an electron have the same value. Show that the energy of the photon is  $(2mc\lambda) / h$  times the kinetic energy of the electron.

Q.5. Electrons are emitted from a photosensitive surface when it is illuminated by green light but electron emission does not take place by yellow light. Will the electrons be emitted when the surface is illuminated by (i) red light, and (ii) blue light?

Q.6. Ultraviolet light of wavelength 2271 Å from a 100 W mercury source radiates a photo cell made of molybdenum metal. If the stopping potential is 1.3 V, estimate the work function of the metal. How would the photo cell respond to high intensity ( $105 \text{ Wm}^{-2}$ ) red light of wavelength 6328 Å produced by a He - Ne laser?

Q.7. Plot a graph showing the variation of photoelectric current with anode potential for two light beams of same wavelength but different intensity.

Q.8. Which experiment proved the existence of De'Broglie waves?

Q.9. Two metals "X" and "Y" have work functions 2eV and 5eV respectively. Which metal will emit electrons when irradiated with light of wavelength 400nm? Find threshold wavelength for both the metals.

Q.10. Light from the bulb falls on a wooden table but no electrons are emitted. Why?

Q.11. A 100W bulb emits yellow light of wavelength 600nm. Find the number of photons emitted per second

Q.12. An electron, an alpha particle and a proton have the same kinetic energy. Which of these will have the largest De'Broglie wavelength

Q.13. In a plot of photoelectric current versus anode potential, how does

- (a) Saturation current vary with anode potential for different frequencies but same intensity
- (b) Stopping potential vary for different intensities but same frequency of radiation
- (c) Photocurrent varies for different intensities but same frequency of incident radiation.

Justify your answer in each case

Q.14. By how much would the stopping potential for a given metal go up if the frequency of the incident radiation were to be increased from  $4 \times 10^{15}$  Hz to  $8 \times 10^{15}$  Hz ?

Q.15. The de Broglie wavelength, associated with a proton and a neutron are found to be equal. Which of the two has a higher kinetic energy?

Q.16. Calculate the de-Broglie wavelength of

- (a) an electron moving with a speed 0.01 times the velocity of light
- (b) A ball of radius 5mm and mass  $3 \times 10^{-2}$  kg moving with a speed of 100m/s

Hence show that wave nature of matter is important at atomic level but not at macroscopic level.

Q.17. What are photons? Mention 5 important properties.

Q.18. A red laser of 2mW operates at a wavelength of 600nm. Estimate the number of photons emitted by this laser per second.

Q.19. Define the following terms

- (a) Photoelectric effect
- (b) Stopping potential
- (c) Threshold frequency
- (d) Threshold wavelength

Q.20. State the four laws of photoelectric emission.

Q.21. What is de-Broglie hypothesis? Hence explain dual nature of matter.

(b) How can we conclude that radiation has dual nature ( Mention 2 important points )

Q.22. Using a proper figure, explain the Davisson and Germer experiment.

Q.23. Find the de-Broglie wavelength of an electron that has been accelerated by a potential difference of 10 KV

Q.24. A material "Z" has a work function of 8eV. Find

- (a) Threshold frequency
- (b) Threshold wavelength
- (c) Stopping potential when light of frequency double the threshold frequency is incident.

Q.25. When a beam of 10.6eV photons of intensity  $2 \text{ W/m}^2$  falls on a platinum surface of area  $10^{-4} \text{ m}^2$  and work function 5.6eV, 40% of the incident photons eject electrons. Find the number of photo-electrons emitted per second and their minimum and maximum kinetic energy. ( IIT )

Q.26. Explain the construction and working of a photo cell.

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**Sample Paper – 2008**  
**Class – XII**  
**Subject – Infomatics Practices**

**Pre-Board Examination 2008**

**Code No. 065**

- Please check that this question paper contains printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 7 questions.
- Please write down the serial number of the question before attempting it.

**Time allowed: 3 hours**

**Maximum Marks: 70**

**Note:**

- (i) *All questions are compulsory.*
- (ii) *Section A consists of 30 marks.*
- (iii) *Section B and Section C are of 20 marks each.*
- (iv) *Answer the questions after carefully reading the text.*

**SECTION A**

**1. Answer the following questions**

- (a) Differentiate between open source software and free software? **2**
- (b) What is data ware housing? How it is useful for organization? **2**
- (c) Draw an entity-relationship diagram to illustrate the case given below:

In a factory, a vendor can supply various items. Each vendor has got a vendor code, vendor name, vendor address and each item also has got an item code, item name, its price per unit. When a vendor supplies an item the transaction is recorded and the information about the transaction stored is date of supply, quantity supplied, order number, item code and vendor code. Map the E/R diagram of corresponding tables. Also identify the key fields.

**2**

- (d) What is DDLC? How it is different from SDLC? **2**



- (e) Explain the concept of Client Server computing. 2

**2. Answer the following questions**

- (a) What is the difference between unloading and hiding of a form? 2  
(b) Differentiate between SDI and MDI form in Visual Basic? 2  
(c) Differentiate between ADODB project reference and ADODC in a form using suitable example. 2  
(d) What is variable life time? What is the lifetime of the following variables? (i) Local (ii) Global (iii) Module 2  
(e) What is Modules in Visual Basic? Explain any two modules in Visual Basic. 2

**3. Answer the following questions.**

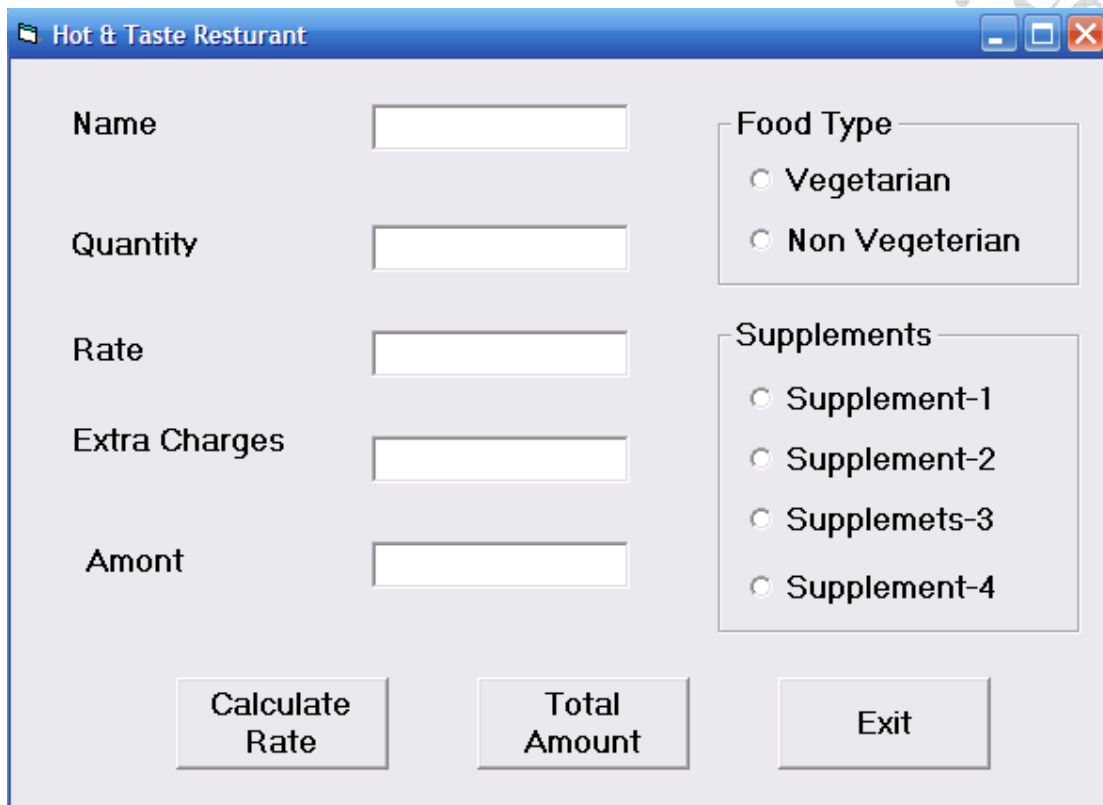
- (a) Differentiate between Decision control and Looping control structure in context with PL/SQ? 2  
(b) What are Cursor attributes? What do these attributes evaluate to when associated with IMPLICIT cursors? 2  
(c) What is the use of a Sub-Query? Which query gets executed first, the parent query or the sub-query? 2  
(d) What is the difference between IN and OUT parameter modes in PL/SOL procedure? 2  
(e) What is a transaction in PL/SQL? What commands are available in PL/SQL for transaction handling? 2



## SECTION B

### 4. Read the following case study and answer the questions that follow:

The Hot & Taste restaurant has computerized its billing. The following the data entry screen used at their outlet. The outlet offers two different types of foods, vegetarian and non-vegetarian. The price of a regular vegetarian THALI meals is Rs. 140/- and that of a non vegetarian THALI meals is Rs.-290/-. The user can choose to have three different types of extra supplements if he wants. Each extra supplement costs Rs. 80/-.



The screenshot shows a Windows-style application window titled "Hot & Taste Resturant". The window contains a data entry form with the following fields and options:

- Name:** A text input field.
- Quantity:** A text input field.
- Rate:** A text input field.
- Extra Charges:** A text input field.
- Amont:** A text input field.
- Food Type:** A group box containing two radio buttons:
  - ☐ Vegetarian
  - ☐ Non Vegeterian
- Supplements:** A group box containing four radio buttons:
  - ☐ Supplement-1
  - ☐ Supplement-2
  - ☐ Supplemets-3
  - ☐ Supplement-4

At the bottom of the window, there are three buttons: "Calculate Rate", "Total Amount", and "Exit".

The list for the above form is as follows:

Object type	Object name
Form	Frmrestro
Text box	Txtname Txtqty Txtrate Txtextracharge Txtamount
Option button	Optveg Optnonveg
Command button	Cmdcalrate Cmdcalamount Cmdexit
Check box	Chksup1 Chksup2 Chksup3

- (a) write the commands to disable the textboxes txtrate, txtextracharge, txtamount and cmdamount ,and set the focus on textbox txtname. **2**
- (b) Write the code for cmdrate to calculate the rate of the food and display it in txtrate depending on the type of food selected by the customer. **2**
- (c) Enable the cmdamount button. Write the code for cmdamount to calculate the total amount and display it on txtamount. If the quantity is more than 10 give 16% discount on supplement. **3**
- (d) Write the code for cmdexit to close the application , before closing the application it should display a message “ Do you really want to close the program(yes/no)? ” .if user select yes it should close the program otherwise set the focus on textbox txtname. **3**

### 5. Answer the following questions:

- (a) Rewrite the following code segment using select case instead of if else:

```

Dim sal as integer 2
If sal >=10000 then
    MsgBox ("New year bonus is 2000")
Elseif sal>=12000 and sal <=15000 then
    MsgBox ("New year bonus is 5000")
Elseif sal= 20000 then
    MsgBox ("New year bonus is 7000")
Else

```

```
Msgbox ("Bonus not applicable")
```

```
End if
```

(b) Give the output of the following statements: 2

i. INSTR(LTRIM(" INFORMATICS"), "ma")

ii. INT(40-20\*4/3+5)

iii. Lcase (left(mid("INFORMATICS", 7,4),3))

iv. Format (now , "dddd,mmmm dd, yyyy")

(c) Find the output of the following code segment : 2

```
Sum=0
```

```
For I = 3 to 7
```

```
If (I mod 2 = 0 ) then
```

```
Sum = sum + i*17
```

```
Else
```

```
Sum = (sum + i*5) -13
```

```
End if
```

```
Next i
```

```
Print sum
```

(d) Write a Visual Basic procedure to print Fibonacci Series. No of elements in the series should be up to the number given as parameter into the procedure.

The Fibonacci series is as follows 0,1 ,1,2,3,5,8, ..... 4

### **SECTION-C**

**6. Answer the following questions:**

(a) Find the errors in the following PL/SQL code and rewrite the corrected code underlining the correction made: 2

```
DECLARE
```

```
    P    NUMBER;
```

```
    Pr   NUMBER := 0;
```

```
FOR X IN 3..6 LOOP
```

```
    IF X MOD 3 := 0 THEN
```

```
        Pr := Pr * X;
```

```
    ELSE
```

```
        Pr := Pr * X;
```

```
        DBMS_OUTPUT.PUT_LINE (TO_CHAR(PR));
```

```
    END OF LOOP;
```

```
END
```

(b) What is the usage of %ROWTYPE attribute? Explain with the help of an example 2

(c) Write the output produced by the following part of code in PL/SQL. 2

```
DECLARE
```

```
    Num  NUMBER;
```

```

V    NUMBER :=0;
BEGIN
FOR Num IN 2..5  LOOP
    V:= V + Num * Num;
    DBMS_OUTPUT.PUT_LINE(V);
END LOOP;
END;
```

(d) Write a PL/SQL procedure that calculates and displays the volume of a cuboid. The procedure takes three parameters for length, width and height of the cuboid respectively. The last two parameters are optional having a default value of -1. If the last two parameters are not passed then the volume of a cube having sides equal to the first parameter is to be calculated.

4

7. Answer the questions based on the tables **EMP\_MASTER** and **AIR\_SAHARA** given below:

Table: EMP\_MASTER

TABLE:

Column Name	Data Type	size	Constraint
EMP_NO	Number	10	Primary key
FNAME	Varchar2	25	Not null
LNAME	Varchar2	25	Not null
DOB_INC	Date		
POSITION	Varchar2	25	Not null

AIR\_SAHARA

Column Name	Data Type	Size	Constraint
FLIGHT_NO	Number	10	Primary key
ORIGIN	Varchar2	25	Not null
DESTINATION	Varchar2	25	Not null
SEATS	Number	4	
FLT_DATE	Date		Not null
FLT_PRICE	Number	(8,3)	
EMP_NO	Number	10	Foreign Key EMP_MASTER

(a) Write the SQL command to create the above tables with constraints. 3

(b) Write the SQL command to create a view consisting of fname, lname and position of all the employees whose destination is CHENNAI. 2

(c) Write the SQL command to modify the data type of EMP\_MASTER table SEATS - Number to Varchar2. 1

(d) Create a Trigger to change FLT\_PRICE to 50,000 every time the FLT\_PRICE entered by the user exceeds 30,000. An appropriate message should also be displayed.

**4**