Class: XII SESSION:2023-2024
HBSE SAMPLE QUESTION PAPER (THEORY)
SUBJECT: PHYSICS

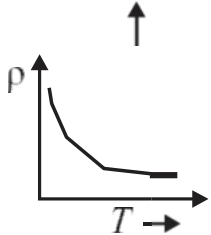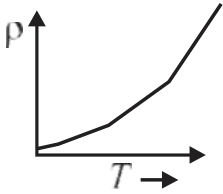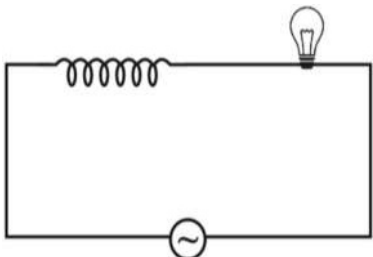**Maximum Marks**:70 Marks   **Time Allowed**:3 hours.

General Instructions:

(1) There are 35 questions in all. All questions are compulsory

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All these Sections are compulsory.

(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.

(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.

5. Use of calculators is not allowed.

SECTION A

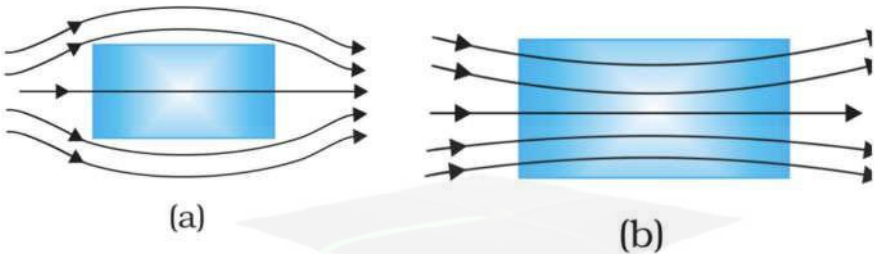| Q. NO.		MARKS
1	**The electric potential on the axis of an electric dipole at a distance 'r from it's centre is V. Then the potential at a point at the same distance on its equatorial line will be** (i) 2V (ii) -V (iii) V/2 (iv) Zero	1
2	**Resistance of conductor does not depend on** (i) Length of conductor (ii) Nature of material (iii) Radius of cross section of conductor (iv) Potential difference applied across the conductor	1

3	**The temperature (T) dependence of resistivity of materials A and material B is represented by fig(i) and fig (ii) respectively. Identify material A and material B.** fig. (i) fig. (ii) (i) material A is copper and material B is germanium (ii) material A is germanium and material B is copper (iii) material A is nichrome and material B is germanium material A is copper and material B is nichrome	1
4	**Wheatstone bridge cannot be used for measuring of very ………………….resistances** (i) high (ii) low (iii) low or high (iv) medium value	1
5	**If the magnetizing field on a ferromagnetic material is increased, its permeability** (i) decreases (ii) increases (iii) remains unchanged (iv) first decreases and then increases	1
6	**An iron cored coil is connected in series with an electric bulb with an AC source as shown in figure. When iron piece is taken out of the coil, the brightness of the bulb will** **(i)** decrease **(ii)** increase **(iii)** remain unaffected (iv) fluctuate 	1

7	A ray of light passing from air through an equilateral glassprism undergoes minimum deviation when the angle ofincidence is ¾ of the angle of prism. speed of light in theprismis. i) c ii) c/2 iii) c/4 **(iv)** none	1
8	Which of the following statement is NOT true about thepropertiesof electromagneticwaves? (I)These waves do not require any material medium for theirpropagation (ii) Both electric and magnetic field vectors attain the maxima andminimaat thesametime (iii) The energy in electromagnetic wave is divided equally betweenelectricand magneticfields iv) Both electricand magnetic field vectors areparalleltoeachother	1

9	In two positions convex lens produces magnified image of givenobject.Thepositions are
	  i) At f,at2f
	  ii) Betweenf and2f,between opticalcenter andf
	  iii)Beyond2f, betweenc and f
	  iv) At2f,betweenopticalcentreandf
		1

10	If Young's double slit experiment is immersed in water, thenfringewidth (i)decreases (ii) increases(iii)remainsame (iv)none	1
11	The work function for a metal surface is 4.14 eV. The thresholdwavelengthfor thismetal surfaceis: (i) 4125Å (ii)2062.5Å (iii) 3000Å (iv) 6000Å	1

12	The radius of the inner most electron orbit of a hydrogen atom is 5.3×10^{-11} m. The radius of the n=3 orbit is i) 1.01×1^{-10} m ii) 1.59×10^{-1} m iii) 2.12×10^{-10} m iv) 4.77×10^{-10} m	1
13	**Which of the following statements about nuclear forces is not true?** **(i)** The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometers. **(ii)** The nuclear force is much weaker than the Coulomb force. **(iii)** The force is attractive for distances larger than 0.8 fm and repulsive if they are separated by distances less than 0.8 fm. **(iv)** Then nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same.	1
14	**Power of lens is 10 diopters, which of following is correct** (i) Convex lens of focal length 10 metre (ii) Convex lens of focal length 10 cm (iii) Concave lens of focal length 10 metre (iv) Concave lens of focal length 10 cm	1

15-18 Two statements are given-one labeled Assertion(A) and the other labeled Reason(R). Select the correct answer to these questions from the codes (a),(b),(c) and (d) as given below. a) Both A and R are true and R is the correct explanation of A b) Both A and R are true and R is NOT the correct explanation of A c) A is true but R is false d) A is false and R is also false **15.** Assertion : A p-type semiconductors is a positive type crystal. Reason : A p- type semiconductor is an uncharged crystal.	1	

16.	**ASSERTION(A):** Theelectrical conductivityof asemiconductorincreasesondoping. **REASON (R) :** Dopingalways increases the number of electrons in thesemiconductor.	
17	**Twostatementsaregiven-onelabeled Assertion (A) and the other labelled Reason (R). Select thecorrectanswer to these questions fromthecodes (a),(b),(c)and (d)asgivenbelow.** **a)** Both Aand Raretrueand Risthe correctexplanation ofA **b)** Both Aand Raretrueand Ris NOTthe correctexplanationofA **c)** Aistruebut Ris false **d)** Aisfalseand Ris also false **ASSERTION:** In an interference pattern observed in Young's double slitexperiment, if the separation (d) between coherent sources as well asthedistance (D) of the screen from the coherent sources both are reduced to1/3$^{rd.}$,thennewfringewidth remainsthe same. **REASON:** Fringewidthisproportionalto(d/D).	1
18	**Two statements are given-one labeled Assertion (A) and theother labelled Reason (R). Select the correct answer to thesequestions from the codes (a), (b), (c) and (d) as given below.**a)BothAandRare true andRisthecorrect explanationof A b) Both Aand RaretrueandRisNOTthecorrect explanation ofA **c**) Aistruebut Ris false d) Ais falseand Risalso false **Assertion(A):** The photoelectrons produced by a mono chromatic light beamincidenton ametalsurfacehaveaspreadintheirkineticenergies. **Reason(R):** The energy of electrons emitted from inside the metal surface, islostin collision withthe other atoms inthemetal.	1

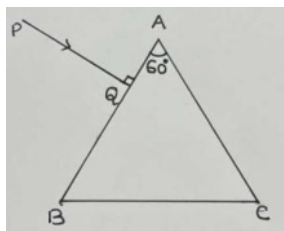| 19	Electromagneticwaveswith wavelength
	    (i) λ_1 is suitable for radar systems used in air craftnavigation.
	    (ii) $\lambda_2$isusedtokillgermsinwaterpurifiers.
	Identify and name the part of the electromagnetic spectrum towhichthese radiations belong.
		2

20	A uniform magnetic field gets modified as shown in figurewhentwospecimensAandBareplaced init. Identifythe specimenAandB.	2
21	State biot savarts law.?OR Stateamperescircuitallaw	2
22	Stateworkingprincipleofmovingcoilgalvanometer?	2
23	A proton, deutron and alpha particle enter with same momentumperpendicular to same magnetic field. What is The ratio of radii ofproton,deutron and alphaparticle	2
24	A narrow slit is illuminated by a parallel beam of monochromaticlight of wavelength λ equal to 6000 Å, separation between the slitis2 cm. whatis the angular width of the central maxima.	2
25.	Define distance of closest approach in Rutherford alpha scatteringexperiment. Writemathematical formula. OR Explain Rutherford alpha scattering experiment.	2

	SECTIONC	
26.	Two large, thin metal plates are parallel and close to each other.On their inner faces, the plates have surface charge densities ofopposite signs and of magnitude $17.7 \times 10^{-22} C/m^2$. What is electricfieldintensityE: (a) intheouter regionofthefirstplate,and (b) betweentheplates?	3
27	Statelawsofphotoelectric effect?	3
28	Explaintheprocessesofnuclearfissionandnuclearfusionbyusingtheplotofbinding energypernucleon(BE/A)versusthemassnumberA.	3
29	An a.c. source generating a voltage $\varepsilon = E_0 \sin \omega t$ is connected to acapacitor of capacitance C .Find the expression for the current Iflowing through it. Plot a graph of ε and I versus ωt to show thatthecurrent isahead ofthevoltage by$\pi/2$. **OR** An ac voltage $V = V_0 \sin \omega t$ is applied across a pure inductor ofinductance$L$. Find an expression for the current i, flowing in thecircuit and show mathematically that the current flowing through itlags behind the applied voltage by a phase angle of$\pi/2$..Also drawgraphsof$V$and$I$versus ωtforthecircuit.	3
30.	WriteBohr'spostulatesforthehydrogenatommodel.	

SECTIOND

| 31 | What is p n junction diode. Explain the process involved information of p n junction diode with the help of suitablediagram
OR
Explain principle and working of p n junction diode in fullwave rectifier? | 5 |

32	(a) Explain the term drift velocity of electrons in a conductor.Hence obtain the expression for the current through aconductorin terms ofdrift velocity.	5
	(b) Twocellsofemfs E_1 and E_2 andinternalresistances r_1 and r_2 respectivelyareconnectedinparallel asshown inthefigure.	
	Deducetheexpression forthe	
	(i) Equivalentemfof thecombination	
	(ii) equivalentinternalresistanceofthecombination	
	(iii) potentialdifferencebetweenthe points A and B.	
	OR	
	(a) State the two Kirchhoff's rules used in thenanalysisofelectriccircuitsandexplainthem .	
	(b) Derivethe equationofthebalanced stateina WheatstonebridgeusingKirchhoff'slaws.	
33	a) Prove prism formula	5
	b) ArayPQisincidentnormallyonthefaceAB ofa	

triangularprismofrefractingangle60^0asshowninfigure.The prism is made of a transparent material ofrefractive index$2/\sqrt{3}$. Trace the path of the ray as it passesthrough the prism. Calculate the angle of emergence andtheangleofdeviation.

OR

(i) A ray of light incident on face AB of an equilateralglass prism, shows minimum deviation of $30°$.Calculatethe speed oflight through theprism.

(ii)FindtheangleofincidenceatfaceABsothattheEmerg entraygrazesalong thefaceAC.

SECTIONE

34	CaseStudy:	4
	Readthefollowing paragraphandanswerthequestions.	

Smallest charge that can exist in nature is the charge of anelectron. During friction it is only the transfer of electron which makesthe body charged. Hence net charge on any body is an integral multipleofcharge of an electron$(1.6 \times 10^{-19}C)$i.e.,$q=\pm ne$ where r=1,2,3,4….

Hence no body can have a charge represented as 1.8e, 2.7e, 2e/5, etc.Recently, it has been discovered that elementary particles such asprotonsor neutrons are elemental unitscalledquarks

I) **Ifachargeonabodyis1nC,thenhowmanyelectronsarepresen t onthebody?**

II) **Chargeis scalarorvector ?**

III) **Apolythenepiecerubbedwithwoolisfoundtohavea negativechargeof3.2×10^{-7}C.Calculatethenumberofelectronstransferred.**

OR

What is charge?
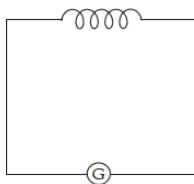
35	**Casestudy:ElectromagneticInduction.**	4
	Readthefollowing paragraphandanswerthequestions	

When a current I flows through a coil, flux linked with it is $\varphi = LI$, where L is a constant known as selfinductance of the coil.

Any charge in current sets up an induced emf in the coil. Thus, selfinductance of a coil is the induced emf set up in it when the currentpassingthroughitchangesattheunitrate.Itisameasureoftheopposition to the growth or the decay of current flowing through thecoil. Also, value of self inductance depends on the number of turns inthe solenoid, its area of cross-section and the permeability of its corematerial.

I)   What is self inductance ?

II)   State the factors on which self inductance of a long solenoid depends?

III)   What is theinducedemfinacoilof10henryinductanceinwhich currentvaries from9 Ato 4 AIn 0.2 second

OR

What is Lenz's law ?