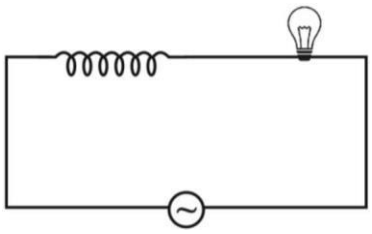
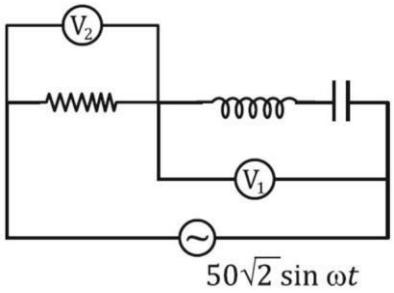
THE VILLAGE
INTERNATIONAL SCHOOL
"We Nurture Dreams"

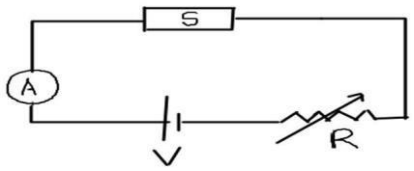
GRADE: XII Date: 11/12/24	MODEL 1 EXAMINATION 2024-25 PHYSICS (042)	Marks:70 Time: 3h

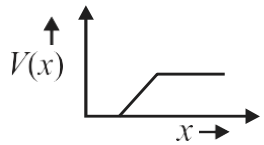
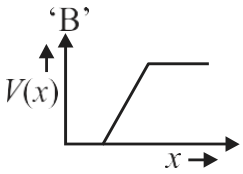
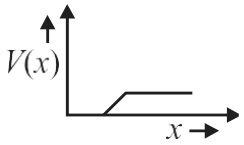
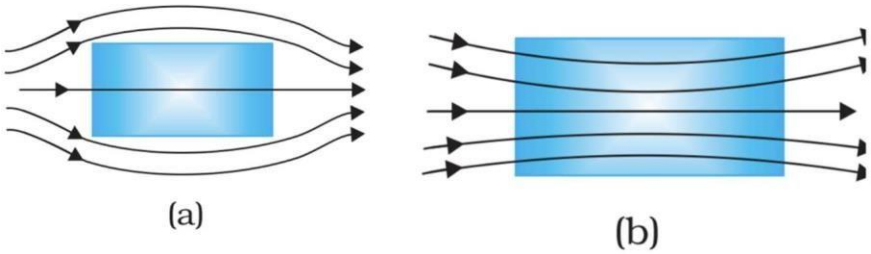
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary
   i. $c = 3 \times 10^8$ m/s
   ii. $m_e = 9.1 \times 10^{-31}$ kg
   iii. $e = 1.6 \times 10^{-19}$ C
   iv. $\mu_0 = 4\pi \times 10^{-7}$ $Tm\boldsymbol{A^{-1}}$
   v. $h = 6.63 \times 10^{-34}$ Js
   vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
   vii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

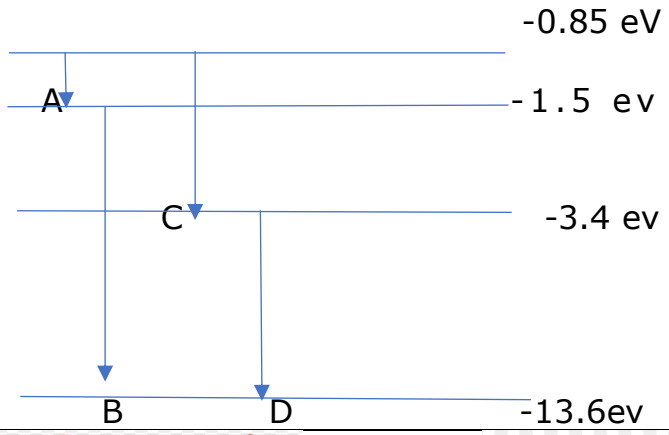
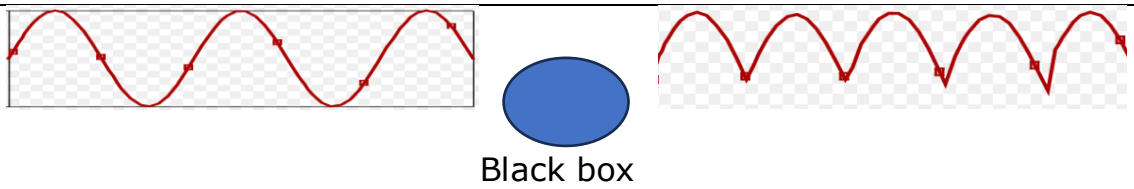
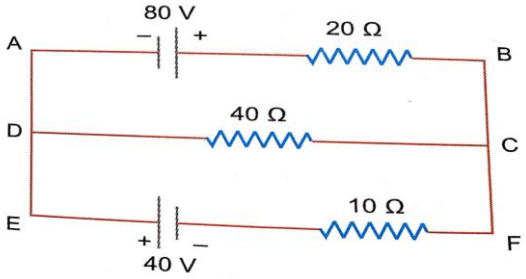
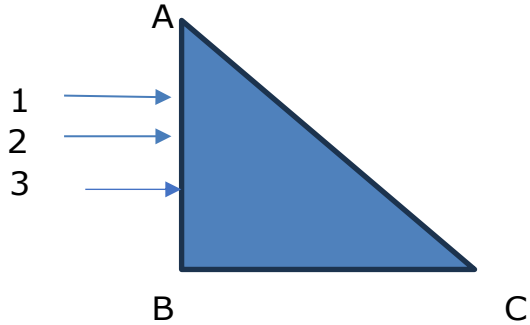
Q. NO.	SECTION A	MARKS
1	In the equation AB = C, A is the current density, C is theelectric field, Then B is (a)resistivity (b)conductivity (c)potential difference (d)resistance	1
2	The electric potential on the axis of an electric dipole at a distance 'r from its center is V. Then the potential at a pointat the same distance on its equatorial line will be (a)2V (b)-V (c)V/2 (d)Zero	1
3	A positively charged particle is released from rest ina uniform electric field. The electric potential energy of the charge (a)remains constant because the electric field is uniform.	1

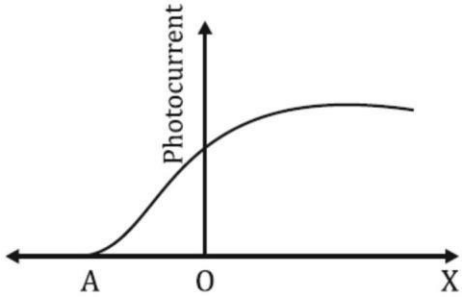
	(b)increases because charge moves along the electric field. (c) decreases because charge moves along the electric field. (d)decreases because charge moves opposite to the electric field.	
4	Two concentric and coplanar circular loops P and Q have theirradii in the ratio 2:3. Loop Q carries a current 9 A in the anticlockwise direction. For the magnetic field to be zero at the common centre, loop P must carry (a)3A in clockwise direction (b)9A in clockwise direction (c)6 A in anti-clockwise direction (d)6 A in the clockwise direction.	1
5	A long straight wire of circular cross section of radius a carriesa steady current I. The current is uniformly distributed acrossits cross section. The ratio of the magnitudes of magnetic field at a point distant a/2 above the surface of wire to that at a point distanta/2 below its surface is (a) 4 :1 (b)1:1 (c)4: 3 (d)3 :4	1
6	If the magnetizing field on a ferromagnetic material isincreased, its permeability (a)decreases (b)increases (c)remains unchanged (d)first decreases and then increases	1
7	An iron cored coil is connected in series with an electric bulbwith an AC source as shown in figure. When iron piece is taken out ofthe coil, the brightness of the bulb will  (a)decrease (b)increase (c)remain unaffected (d)fluctuate	1
8	Name the physical quantity having unit A m^2 (a)Magnetic flux (b)Magnetic dipole moment (c)Intensity ofmagnetic field (d) Pole strength	1

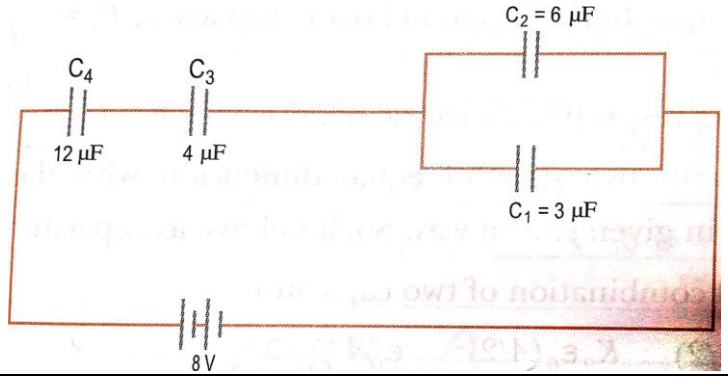
9	If the reading of the voltmeter V1 is 40 V, then thereading of voltmeter V2 is  (a) 30 V (b) 58 V (c) 29 V (d) 15 V	1
10	A magnetic needle is kept in a non-uniform magnetic field. It experiences (a)a torque but not a force. (b)neither a force nor a torque. (c)a force and a torque. (d)a force but not a torque	1
11	The work function for a metal surface is 4.14 eV. Thethreshold wavelength for this metal surface is: (a) 4125 Å (b) 2062.5 Å (c)3000 Å (d)6000 Å	1
12	The radius of the innermost electron orbit of a hydrogenatom is 5.3×10^{-11} m. The radius of the n =3 orbit is (a)1.0×10^{-10} (b)1.59×10^{-10} (c)2.2×10^{-10} (d)4.77×10^{-10}	1
13	QS 13-16, Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questionsfrom 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	1

	Assertion(A): The electrical conductivity of a semiconductor increases ondoping. **Reason(R):** Doping always increases the number of electrons inthe semiconductor.	
14	**Assertion(A):** The photoelectrons produced by a monochromatic light beamincident on a metal surface have a spread in their kinetic energies. **Reason(R):** The energy of electrons emitted from inside the metal surface, is lostin collision with the other atoms in the metal.	1
15	**Assertion (A):** The resolving power of a telescope is more if the diameter of the objective lens is more. **Reason(R):** Objective lens of large diameter collects more light.	1
16	**Assertion(A):** Diamagnetic materials can exhibit magnetism. **Reason (R):** Diamagnetic materials have permanent magnetic dipole moment	1
	SECTION B	
17	In a series LCR circuit with an ac source of effective voltage 50 v, frequency 50/π Hz,R=300Ω,c=20 uF andL=1 H . Find the rms current in the circuit. OR The figure shows a piece of pure semiconductor S in series witha variable resistor R and a source of constant voltage V. Shouldthe value of R be increased or decreased to keep the reading of the ammeter constant, when semiconductor S is heated? Justify your answer 	2
18	What is the shape of the wavefront in each of the following cases: (a)light diverging from a point source (b)light emerging out of a line source OR The graph of potential barrier versus width of depletion region for an unbiased diode is shown in graph A. In comparison to A , graphs B and C are obtained after biasing the diode in different ways. Identify the type of biasing in B and C and justify your answer.	2

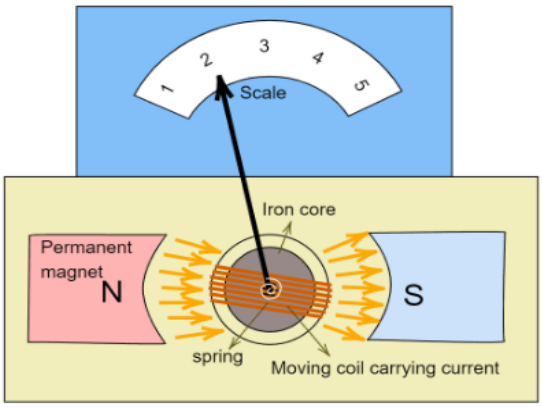
	'A'  'B'  'C' 	
19	(a)An Electromagnetic wave is travelling in a medium with a velocity v. Draw a sketch showing the propagation of the em wave, indicating the direction of the oscillating electric and magnetic fields. (b)How are the magnitude of the electric and magnetic fieldsrelated to the velocity of the em wave? OR A biconvex lens made of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Justify your answer	2
20	A uniform magnetic field gets modified as shown in figurewhen two specimens A and B are placed in it.  (i) Identify the specimen A and B. (ii)How is the magnetic susceptibility of specimen Adifferent from that of specimen B?	2
21	What is the nuclear radius of ^{125}Fe, if that of ^{27} Al is 3.6 fermi? **OR** The short wavelength limit for the Lyman series of thehydrogen spectrum is 913.4 A^0. Calculate the short wavelength limit for the Balmer series of the hydrogen spectrum.	2
	SECTION C	
22	The energy level of an element is given: identify, using necessary calculation, the transition, which corresponds to the emission of a	3

	spectral line of wavelength 482 nm and it belongs to which spectral series. 	
23	 The Black box convert input voltage waveform in to the output voltage waveform. Identify the device Black box, write its principle and draw the circuit diagram and briefly explain its working.	3
24	Using Kirchhofs rules Calculate the current through the 40Ω and 20 Ω resistors in the following circuit  OR Three rays 1.2.3 of different colors falls normally on one of thesides of an right angled prism as shown in figure. Refractive indices of prism these rays is 1.39,1.47 and 1.52 respectively.Trace the path and find which of these rays get internally reflected and which get refracted from face Ac 	3

25	The ground state energy of hydrogen atom is -13.6 eV. The photon emitted during the transition of electron from n=3 to n=1 state, is incident on a photosensitive material of unknown work function. The photoelectrons are emitted from the material with the maximum kinetic energy of 9eV.Calculate the threshold wavelength of the material used. OR  (a) What does X and A on the horizontal axis represent? (b) Draw this graph for three different values of frequencies of incident radiation υ1, υ 2 and υ 3 (υ 3>υ 2>υ1) for the same intensity. Draw this graph for three different values of intensities of incident radiation I1, I2 and I3 (I3> I2>I1) having the same frequency.	3
26	Two long straight parallel conductors carrying currents I_1 and I_2 are separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field produced by one exerts an attractive force on the other. Obtain the expression for this force and hence define 1 ampere. OR Radiation of frequency 10^{15} Hz is incident on three photosensitive surfaces A, B and C. Following observations are recorded: Surface A: no photoemission occurs Surface B: photoemission occurs but the photoelectrons have zero kinetic energy. Surface C: photo emission occurs and photoelectrons have some kinetic energy. Using Einstein's photo-electric equation, explain the three observations.	3
27	(a) Draw the graph showing the variation binding energy per	3

	nucleon with the mass number. (b)Explain with the help of this graph the release of energy in the process of nuclear fission and fusion reaction	
28	In a network ,four capacotors C_1,C_2,C_3,C_4 as connected as shown in figure (a)Calculate the net capacitance in the circuit (b) If the charge on the capacitor C_1 is 6 μC(i)Caculate the charge on the capacitor C_3 and C_4(ii)net energy stored in the capacitor C_3 and C_4 connected in series  	3
	Section D	
29	**Case Study:** ***Read the following paragraph and answer the questions.*** A number of optical devices and instruments have been designed and developed such as periscope, binoculars, microscopes and telescopes utilizing the reflecting and refracting properties of mirrors, lenses and prisms. Most of them are in common use. Our knowledge about the formation of images by the mirrors and lenses is the basic requirementfor understanding the working of these devices. (i) Why the image formed at infinity is often considered mostsuitable for viewing. Explain (ii) In modern microscopes multicomponent lenses are used for boththe objective and the eyepiece. Why? (iii) Write two points of difference between a compoundmicroscope and an astronomical telescope (iv)Write two distinct advantages of a reflecting type telescope over a refracting type telescope.	4
30	Read the following paragraph and answer the questions Moving coil galvanometer operates on _Permanent Magnet Moving Coll (PMMC) mechanism and was designed by the scientist Darsonval. Moving coil galvanometers are of two types (i)Suspendedcoll	4

(ii) Pivoted coil type or tangent galvanometer,
Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the magnetic flux passing through the coil is maximum.



Front view of a Moving Coil Galvanometer

(i) A moving coil galvanometer is an instrument which
(a) is used to measure emf
(b) is used to measure potential difference
(c) is used to measure resistance
(d) is a deflection instrument which gives a deflection when a current flows through its coil

ii) To make the field radial in a moving coil galvanometer.
(a) number of turns of coil is kept small
(b) magnet is taken in the form of horse-shoe
(c) poles are of very strong magnets
(d) poles are cylindrically cut

iii) The deflection in a moving coil galvanometer is
(a) directly proportional to torsional constant of spring
(b) directly proportional to the number of turns in the coil
(c) inversely proportional to the area of the coil
(d) inversely proportional to the current in the coil

iv) In a moving coil galvanometer, having a coil of N-turns of area A and carrying current I is placed in a radial field of strength B. The torque acting on the coil is
(a) NA^2B^2I (b) $NABI^2$
(c) N^2ABI (d) NAB

OR

(v) To increase the current sensitivity of a moving coil galvanometer, we should decrease
(a) strength of magnet
(b) torsional constant of spring
(c) number of turns in coil
(d) area of coil

	SECTION E	
31	(a) Define electric flux. write its SI unit (b)Using gauss law obtain the expression for electric field ata point due to an infinitely long, thin uniformly charged straight wire of linear charge density λ Cm^{-1} OR (a)Three charges –q, Q and +q are placed at equal distances on a straight line. If the potential energy of the system of these charges is zero, then what is the ratio Q:q? (b)(i) Obtain the expression for the electric field intensity due to a uniformly charged spherical shell of radius R at a point distant r from the center of the shell outside it. (ii) Draw a graph showing the variation of electric field intensity E with r, for r > R and r < R.	5
32	(a) State Biot-Savart law. Using this law find an expressionfor the magnetic field at the center of a circular coil of N turns, radius r carrying a current I (b) Sketch the magnetic field for a circular current loop, clearly indicating the direction of the field **OR** (a) State the two Kirchhoff's rules used in the analysis of electric circuits and explain them. (b) Derive the equation of the balanced state in a Wheatstone bridge using Kirchhoff's laws.	5
33	Draw a ray diagram for formation of image of a point object by a thin double convex lens having radii of curvature R1 and R2, hence derive lens makers formula for a double convex lens. state the assumption made and sign convention used OR (a) Explain with the help of a ray diagram, how is image formed in a compound microscope (b) Define and obtain the expression for magnifying power of three lenses are 10 D,5 D,2 D respectively, which one you prefer for an objective and eyepiece of amicroscope	5