SAMPLE QUESTION PAPER 1
Class – XII
PHYSICS

Time allowed: 3hrs **Maximum Marks: 70**

General Instructions:

i. All questions are compulsory. Thereare 26 questions in all.

ii. This question paper has five sections: Section A, Section B, Section C, and Section D & Section E.

iii. Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains eleven questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.

iv. 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 the three questions of five marks weightage. You have to attempt only one of the choices in such questions.

v. You may use the following values of physical constants wherever necessary.

c=3 X 108m/s
h =6.63 X 10-34Js
e=1.6 X 10-19C
μo =4πX 10-7T m A-1
ε0= 8.854X 10-12 C2N-1m-2
me=9.1 X 10-31k
mass ofneutron =1.675X 10-27kg
mass ofproton =1.673 X10-27kg
Avogadro's number =6.023 X 1023per gram mole
Boltzmann constant = 1.38 X 10-23JK-1
1/(4πE_0)=9 X 109N m2C-2

Section A

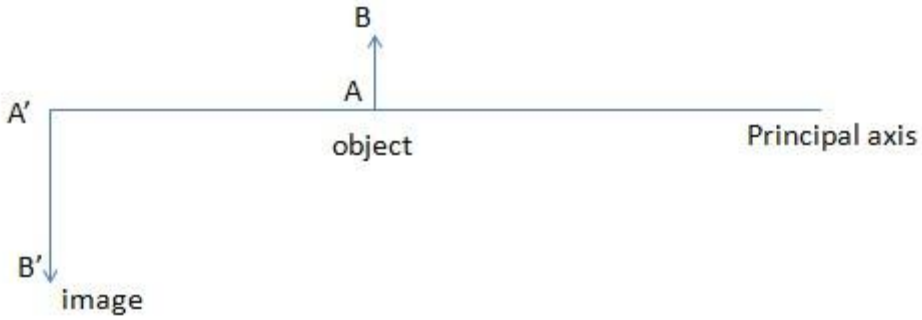
Question number 1 to 5 carry 1 mark each

1. What is the value of the angle between the vector $\vec{s}$ and $\vec{E}$for which the potential energy fan electric dipole of dipole moment$\vec{t}$, kept in an external electric field, $\vec{E}$ has maximum value (1)

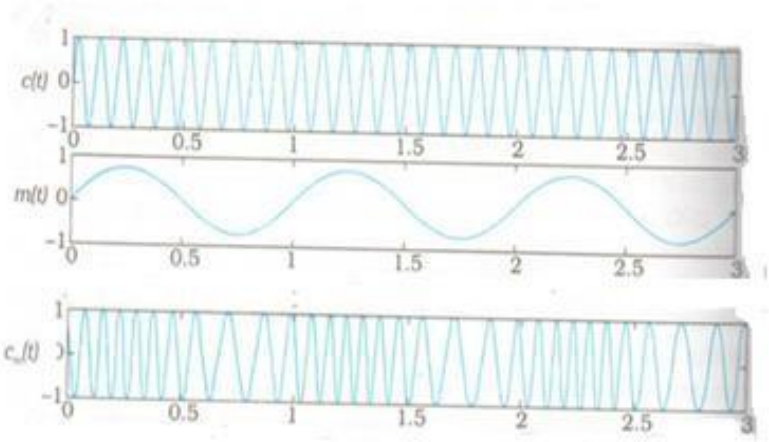
2. Name the colors corresponding to the digits 4 and 7 in the color code scheme for carbon resistors. (1)

3. State which of the two, the capacitor or an inductor, tends to become a SHORT when the frequency of the applied alternating voltage has a very high value. (1)

4. Redraw the diagram given below and mark the position of the centre of curvature of the spherical mirror used in the given set up. (1)



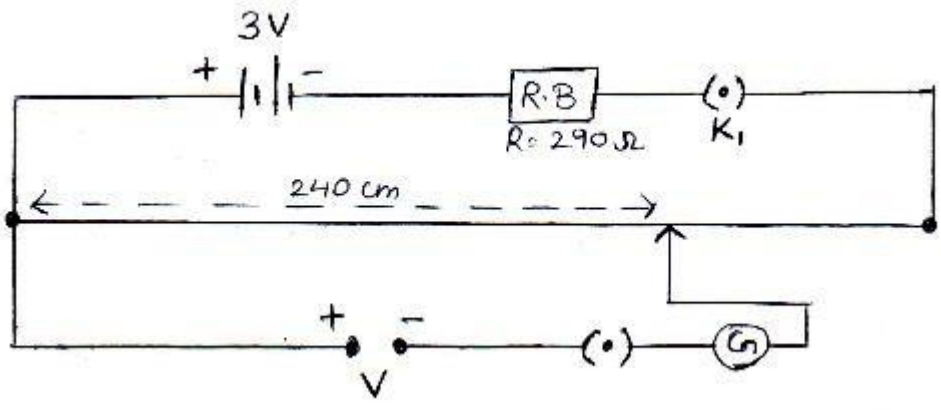
5. In the given diagram C(t) stands for the carrier wave and m(t) for the signal to be transmitted. What name do we give to the wave labeled as Cm(t) in the diagram? (1)



Section B

Question number 6 to 10 carry 2 mark each

6. Calculate the value of the unknown potential V for the given potentiometer circuit. The total length (400 cm) of the potentiometer wire has a resistance of 10Ω and the Balance point is obtained at a length of 240 cm. (**2)**



7. Name the phenomenon which proves transverse wave nature of light. Give two uses of the devices whose functioning is based on this phenomenon. (2)

8. The equivalent wavelength of a moving electron has the same value as that of a photon having an energy of 6 X 10^{-17}J. Calculate the momentum of the electron. (2)

9. The short wavelength limit for the Lyman series of the hydrogen spectrum is 913.4 Å. Calculate the short wavelength limit for Ballmer series of hydrogen spectrum. (2)

10. (a) Arrange the following networks in increasing order of the number of computers that may be present in the network: Internet; LAN; WAN

(b) What is the minimum number of satellites that enables a Global Positioning System (GPS) receiver to determine one's longitude/latitude position, i.e., to makea2D position fix. (2)

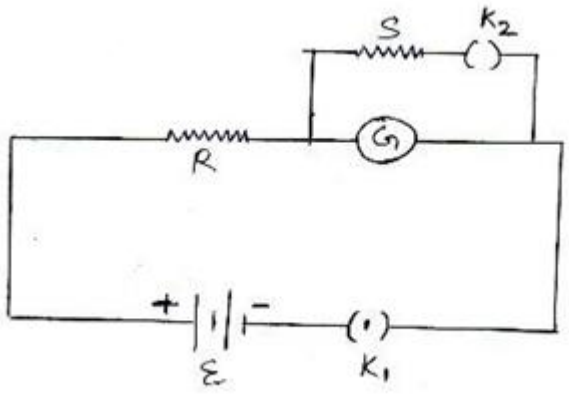
Section C

Question number 11to 21 carry 3 mark each

11. Eight identical spherical drops, each carrying a charge1 n Care at a potential of 900 V each. All these drops combine together to form a single large drop. Calculate the potential of this large drop. (Assume no wastage of any kind and take the capacitance of asp here of radius r as proportional to r). (3)

12. The current flowing in the galvanometer G when the key k_2 is kept open is I. On closing the key k_2, the current in the galvanometer becomes I/n, where n is an integer.

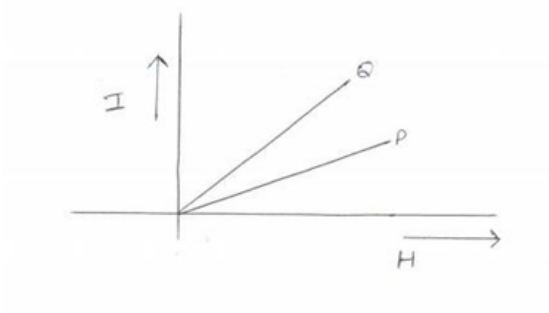
Obtain an expression for resistance R_G of the galvanometer in terms of R, Sand n. To what form does this expression reduce when the value of R is very large as compared to S? (3)



Use this expression, and the sign convention that the:

OR

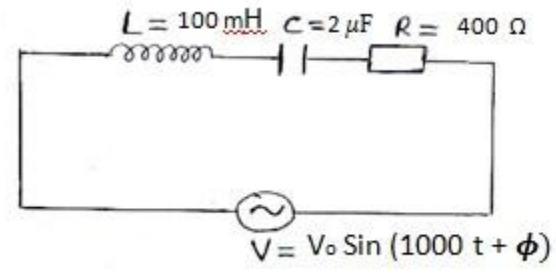
The given graphs show the variation of intensity of magnetization I with strength of applied magnetic field H for two magnetic materials P and Q.



(i) Identify the materials P and Q.

(ii) For material P, plot the variation of Intensity of Magnetization with temperature. Justify your answer.

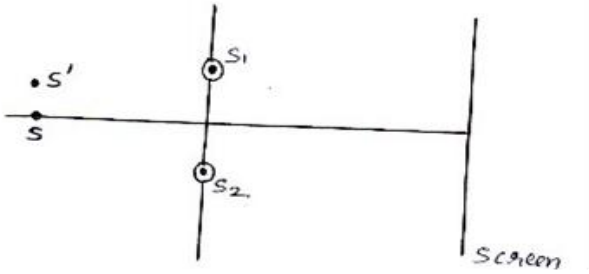
13. Find the value of the phase lag/lead between the current and voltage in the given series LCR circuit. Without making any other change, find the value of the additional capacitor, such that when 'suitably joined' to the capacitor(C= 2μF) as shown, would make the power factor of this circuit unity. (3)



14. Explain how one 'observes an inconsistency' when Ampere's circuital law is applied to the process of charging a capacitor. How this 'contradiction' gets removed by introducing the concept of an 'additional current', known as the 'displacement current'? (3)

15. A point object O is kept at a distance of 30 comfort a convex lens ofpower+4D towards its left. It is observed that when a convex mirror is kept on the right side at a distance of 50 cm from the convex lens, the image of the object O formed by the lens-mirror combination coincides with the object itself. Calculate the focal length of the convex mirror. (3)

16. The arrangement used by Thomas Young to produce an interference pattern is shown in the given diagram. Justify why there would be no change in the 'fringe width' when the main
Illuminated slit (S) is shifted to the position s' as shown. (3)



17. A given number of atoms N_0 of a radioactive element with a half life is uniformly distributed in the blood stream of a

(i) Normal personA having total volume V of blood in the body

(ii) Person Bin need of blood transfusion having a volume V' of blood in the body.

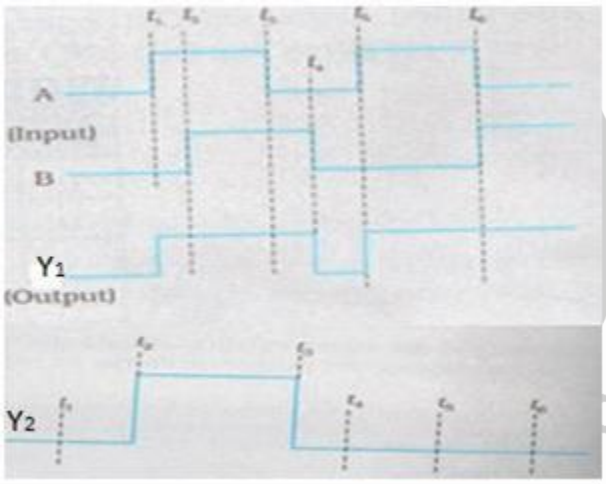
The number of radioactive atoms per unit volume in the blood streams of the two persons after a time n T are found to be $N_1$and N_2.Prove mathematically that the additional volume of blood that needs to betransfused in the body of person B equals$\left(\frac{N^2 - N^1}{N^2}\right)$ (3)

18. A student has to use an appropriate number of

(i) NAND gates (only) to get the output Y_1

(ii) NOR gates (only) to get the output Y_2

From two given inputs A and B as shown in the diagram.



Identify the 'equivalent gate' needed in each case. Show how one can connect an appropriate number of (i) NAND (ii) NOR gates respectively in the two cases to get these 'equivalent gates'. (3)

19. The data given below gives the photon energy (in eV) for a number of waves whose wavelength values (in nm) are also given (3)

Wavelength (in nm)	200	400	600	800	1000	1200
Photon Energy(in eV)	6.216	3.108	2.072	1.554	1.243	1.036

(Without doing any calculation/taking any reading), explain how one can use this data to draw an appropriate graph to infer

(i) photon energy corresponding to a wavelength of 100 nm.

(ii) the wavelength value (innm) corresponding to a photon energy of 1eV.

(iii) Velocity of light assuming that the value of Plank's constant is known.

20. A (sinusoidal) carrier wave (3)

$C(t)=A_C \sin \omega_C t$

is amplitude modulated by a (sinusoidal) message signal $m(t) = A_m \sin \omega_m t$

Write the equation of the (amplitude) modulated signal.

Use this equation to obtain the values of the frequencies of all the sinusoidal waves present in the modulated signal.

21. Give reasons for the following: (3)

(i) The Zener diode is fabricated by heavily doping both the p and n sides of the junction

(ii) A photodiode, when used as a detector of optical signals is operated under reverse bias.

(iii) The band gap of the semiconductor used for fabrication of visible LED's must at least be 1.8 eV.

Section D

Question number 23 carry 4 mark each

23. Dimpi's class was shown a video on effects of magnetic field on a current carrying straight conductor. She noticed that the force on the straight current carrying conductor becomes zero when it is oriented parallel to the magnetic field and this force becomes maximum when it is perpendicular to the field. She shared this interesting information with her grandfather in the evening. The grandfather could immediately relate it to something similar in real life situations. He explained it to Dimpi that similar things happen in real life too. When we align and orient our thinking and actions in an adaptive and accommodating way, our lives become more peaceful and happy. However, when we adopt an unaccommodating and stubborn attitude, life becomes troubled and miserable. We should therefore always be careful in our response to different situations in life and avoid unnecessary conflicts.

Answer the following question based on above information:

a) Express the force acting on a straight current carrying conductor kept in a magnetic field in vector form. State the rule used to find the direction of this force.

b) Which one value is displayed and conveyed by grandfather as well as Dimpi?

c) Mention one specific situation from your own life which reflects similar values shown by you towards your elders. (4)

Section E

Question number 24to 26 carry 5 mark each

24 a) State the theorem which relates total charge enclosed within a closed surface and the electric flux passing through it.Prove it for a single point charge.

b) An 'atom' was earlier assumed to be asphere of radius a having appositively charged point nucleus of charge+Zeat its centre. This nucleus was believed to be surrounded by a uniform density of negative charge that made the atom neutral as a whole.

Use this theorem to find the electric field of this 'atom' at a distance(r<a) from the centre of the atom. (5)

25. State the law which relates to generation of induced emf in a conductor being moved in a magnetic field.

Apply this law to obtain an expression for the induced emf when one'rod' of a rectangular conductor is free to move in a uniform, time independent and 'normal' magnetic field.

Apply the concept of the Lorentz(magnetic) force acting on a moving charge to justify the expression obtained above. (5)

26. State Huygens's principle in wave-optics. How did Huygen 'explain' the absence of the back wave?

Use this principle to draw the refracted wave front for a plane wave incident from a denser to a Rarer medium. Hence obtain Snell's law of refraction. (5)