SET – II

Subject Code: 042

COMMON PRE-BOARD EXAMINATION 2017-2018

PHYSICS

Time allowed: 3 hours Maximum Marks: 70

Class: XII

General Instructions:

(i) *All questions are compulsory. There are 26 questions in all.*

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

(iii) *Section **A** contains **five** questions of **one** mark each, Section **B** contains **five** questions of **two** marks each, Section **C** contains **twelve** 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. You have to attempt only **one** of the choices in such questions.*

(v) *You may use the following values of physical constants wherever necessary :*

$c = 3 \times 10^8 m/s$

$h = 6.63 \times 10^{-34} Js$

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

$\mu_0 = 4\pi \times 10^{-7} T\ m\ A^{-1}$

$\varepsilon_0 = 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ \mathrm{N\ m^2 C^{-2}}$

Mass of electron = 9.1×10^{-31} kg

Mass of neutron = 1.675×10^{-27} kg

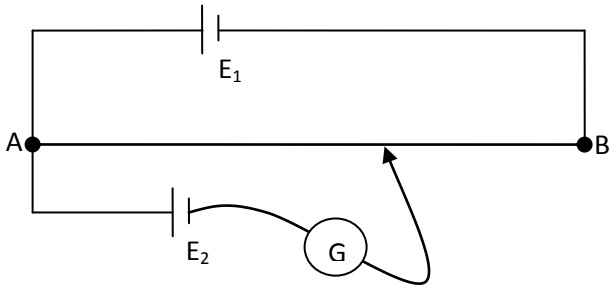
Mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK

SECTION – A

1. Potentiometer wire AB is connected to a cell E_1 of negligible internal resistance. If thickness of the wire AB is increased, in which direction will the balance point J shift? Why?



1

2. Define mobility of electrons. Write its unit. **1**

3. In an LCR – circuit, capacitance is changed from C to 2C. What should be the change in the inductance such that the resonant frequency to remain unchanged? **1**

4. State two applications of Infra- red radiations. **1**

5. In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii) base current? **1**

SECTION – B

6. Show that in an electromagnetic wave, the average energy density of electric field is equal to the average energy density of magnetic field. **2**

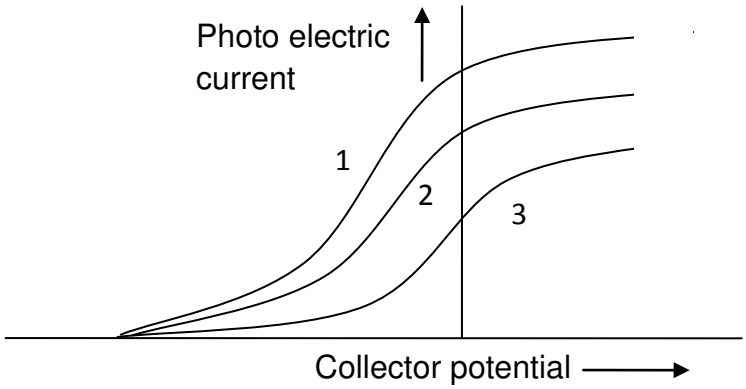
7. Derive an expression for the electric field E due to a dipole of length '2a' at a point distant 'r' from the centre of the dipole on the axial line. **2**

OR

A dipole of dipole moment '**p**' is placed in uniform electric field **E** such that dipole moment makes an angle θ with the electric field. Obtain an expression for torque experienced by the dipole. **2**

8. Define the following terms in communication. (i) Attenuation (ii) Transducer. **2**

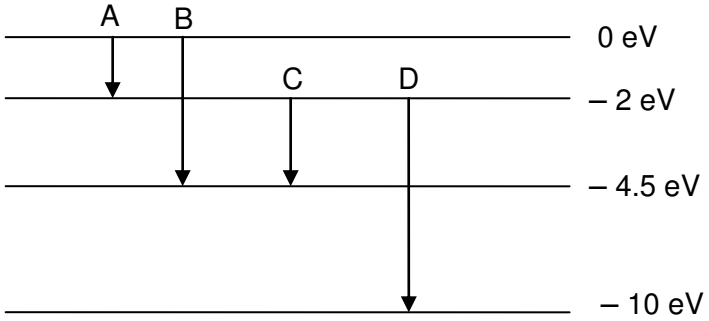
9. The graph below shows variation of photo-electric current with collector plate potential for different radiations.



(i) Which physical parameter is kept constant for the three curves?

(ii) Which radiation will emit photo electron of largest kinetic energy? Why? **2**

10. The energy levels of an atom are as shown in figure. (i) Which one of these transitions will result in the emission of a photon of wavelength 275 nm? (ii) Which transition corresponds to emission of radiation of maximum wavelength?



2

SECTION – C

11. (a) When an ac source is connected to an ideal capacitor show that the average power supplied by the source over a complete cycle is zero.

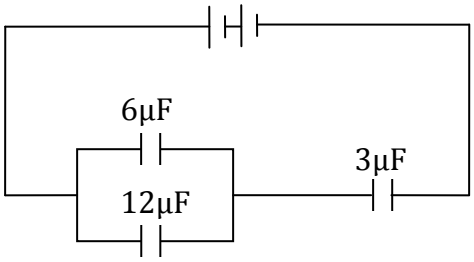
(b) A lamp is connected in series with a capacitor and an AC source. What happens to the brightness of the lamp when the key is plugged in and space between the plates of the capacitor is filled with a dielectric slab? **3**

12. In the arrangement of capacitors shown below, the energy stored in the 6μF capacitor is E. Find the following:

    (i) Energy stored in the 12μF capacitor,

    (ii) Energy stored in the 3μF capacitor,

    (iii) Total energy drawn from the battery.



3

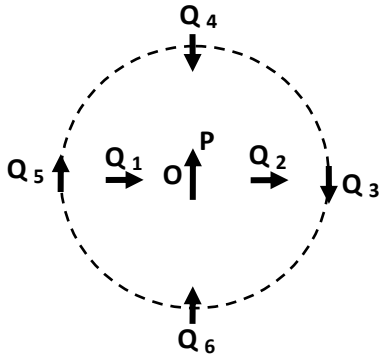
13. Draw a labeled diagram of reflecting type telescope. Write any two advantages of reflecting type telescope over refracting type **3**

14. Figure shows a small magnetized needle P placed at the centre O of a circle. The arrow shows the direction of its magnetic moment. The other arrows show different positions (and orientations of the magnetic moment) of another identical magnetized needle Q.

    (a) In which configuration the system is not in equilibrium? Justify.

    (b) In which configuration is the system in (i) stable, and (ii) unstable equilibrium? Justify your answer.

    (c) Which configuration corresponds to the lowest potential energy among all the configurations shown? Justify your answer.



3

15. Establish the mirror formula for a convex mirror. State the assumptions used. **3**

16. Two metallic spheres A and B, of each of radius R carrying charges $Q_A = -2\mu C$ and $Q_B = 8\ \mu C$ respectively are separated by some distance.
    (i) Calculate the amount of charge on each sphere, if they are touched against each other and brought back to their original position.
    (ii) What happens to the nature of the force between them after touching each other?
    (iii) If radius of the sphere B is 2R, what will be your answer to (i)?
    (iv) Write the two properties of electric charge that you have used in this question. **3**

17. What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations:
    (i) The screen is moved away from the plane of the slits;
    (ii) The source slit is moved closer to the double-slit plane;
    (iii) The monochromatic source is replaced by a source of white light. **3**

18. Explain with the help of a circuit diagram how a Zener diode works as a DC voltage regulator. Draw its I – V characteristics. **3**

19. What are the observations made in the Davisson and Germer experiment? How these observations led to the verification of wave nature of matter? **3**

OR

Derive an expression for the de – Broglie wavelength associated with an electron accelerated from rest through a potential difference V.

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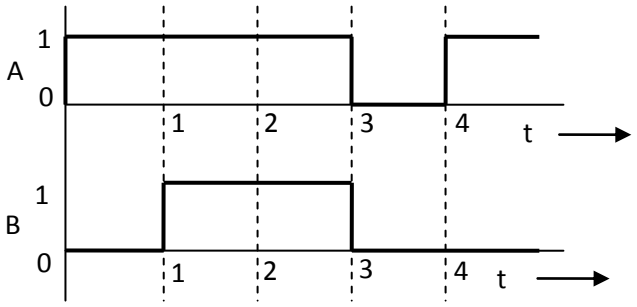
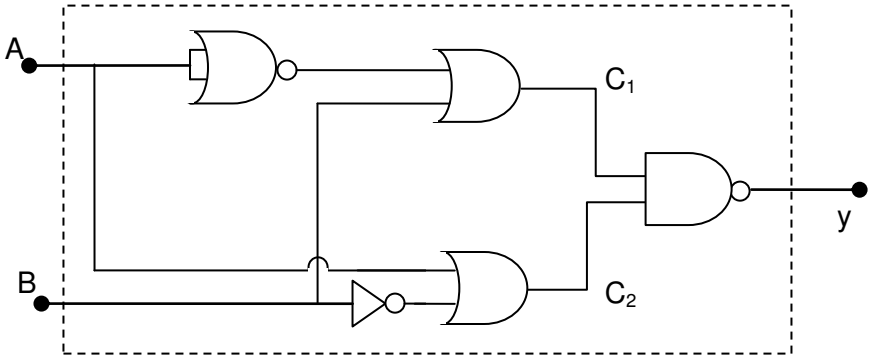
20. Input signal A and B are applied to the input terminals of the dotted box set – up shown here.





Let y be the final output signal from the box. Draw the waveforms of the signals labeled as C_1 and C_2 within the box, giving (in brief) the reasons for getting these waveforms. Hence, draw the wave form of the final output signal y. Give reasons for your choice. **3**

21. Draw the general shape of the B.E/ nucleon versus (E_{bn}) mass number (A) of an atomic nucleus curve and explain how it helps to understand the release of energy during nuclear fission and fusion. **3**

22. (a) Write any two factors which demonstrate the need for modulating a signal.
(b) Draw a suitable diagram to show amplitude modulation using a sinusoidal signal as the modulating signal. **3**

SECTION – D

23. During a thunderstorm the 'live' wire of the transmission line fell down on the ground. A group of boys passing through noticed it and some of them wanted to place the wire by the side. As they were approaching the wire and trying to lift it, Hari noticed it and immediately pushed them away to prevent them from touching the wire. Two of them got hurt in the process. Hari took them to a doctor to get medical aid.

(a) Write two values which Hari displayed during the incident.

(b) Why is it that a bird can perch over a suspended 'live' wire without any harm whereas touching it on the ground can give a fatal shock?

(c) The electric power from a power plant is set up to a very high voltage before transmitting it to distant consumers. Write the reason for it. **4**

SECTION – E

24. (a) Using Biot – Savart's law, derive an expression for the magnetic field intensity at appoint on the axis of a circular current carrying coil.

(b) A straight wire, of length L, carrying a current I, stays suspended horizontally in mid air in a region where there is a uniform magnetic field B, The linear mass density of the wire is λ. Obtain the magnitude and direction of this magnetic field.

5

OR

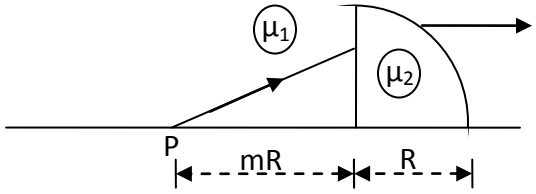
(a) State Ampere Circuital Law.

(b) What is an *amperian* loop.

(c) A long straight wire of a circular cross-section of radius '*a*' carrying steady current '*I*'. The current *I* is uniformly distributed across this cross-section. Calculate the magnetic field in the region $r < a$ and $r > a$.

(d) Show the variation of graph between Magnitude of magnetic field and distance '*r* 'from the centre of the wire. **5**

25. (a) A concave lens made up of glass is immersed in water. What change do you expect in its focal length as compared to its value in air? Why?



(b) A quarter cylinder of radius R and refractive index 1.5 is placed on a table. A point object P is kept at a distance of mR from it. Find the value of m for which a ray from P will emerge parallel to the table as shown in the figure.

5

OR.

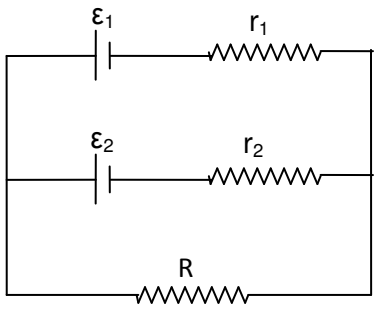
(a) State Brewster's law. Show that the reflected and the refracted ray are perpendicular to each other, when the angle of incidence is equal to polarizing angle.

(b) Two polaroids P_1 and P_2 are set in crossed positions. A third Polaroid P_3 is placed in between them making an angle θ with the pass axis of the first Polaroid. Find the value of θ for which the intensity of light emerging from P_2 is $\frac{I_0}{8}$, where I_0 is the intensity of light on the Polaroid P_1 **5**

26. Two cells of e.m.fs ε_1, ε_2 and internal resistance r_1 and r_2 respectively are connected in parallel to an external resistance R as shown in figure.

(i) Deduce the expression for the equivalent e.m.f. and internal resistance of the combination,

(ii) What should be the value of resistance R such that Potential difference across the resistance R is equal to e.m.f ε_1?



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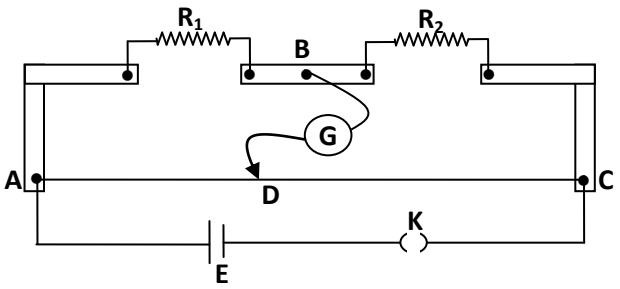
OR

(a) Using Kirchhoff's laws, establish the balancing condition for Wheatstone bridge.

(b) In the meter bridge experimental set up, shown in the figure, the null point 'D' is obtained at a distance of 40 cm from end A of the meter bridge wire. If a resistance of 10 Ω is connected in series with R_1, null point is obtained at AD = 60 cm. Calculate the value of R_1 and R_2.



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