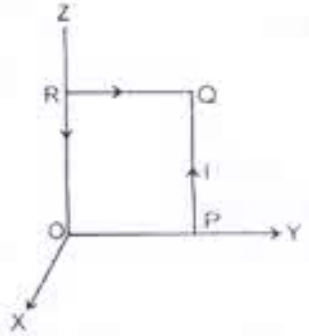
Archit gupta

None

CODE – 042 (S) B
2016-17

Q 1-5	1 mark
Q 6-10	2 marks
Q 11-22	3 marks
Q23	4 marks
Q 24-26	5 marks

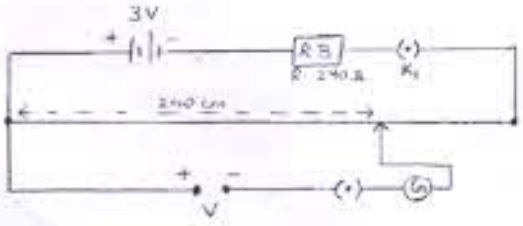
1. What is the value of the angle between the vectors p and E for which the potential energy of an electric dipole of dipole moment p, kept in an external electric field E, has maximum value?
2. Name the colours corresponding to the digits 4 and 7 in the colour code scheme for carbon resistors.
3. State 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.
4. A square coil, OPQR, of side a, carrying a current I, is placed in the Y-Z plane as shown here. Find the magnetic moment associated with this coil.



5. Two dipoles, made from charges ± q and ± Q, respectively, have equal dipole moments. Give the ratio between the 'separations' of the these two pairs of charges

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 10 Ω and the balance point is obtained at a length of 240 cm.

1.2V



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

OR

Name the phenomenon which is responsible for bending of light around sharp corners of an obstacle. Under what conditions does this phenomenon take place? Give one application of this phenomenon in everyday life.

8. Two point charges, q1 and q2, are located at points (a, o, o) and (o, b, o) respectively. Find the electric field, due to both these charges, at the point, (o, o, c).
9. Obtain expression for torque experienced by a current carrying rectangular coil kept in an external magnetic field.
10. Differentiate between phenomena of interference and diffraction.
11. Eight identical spherical drops, each carrying a charge 1 nC are 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.

12. Explain an experiment to find the internal resistance of a given primary cell.

13. 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.

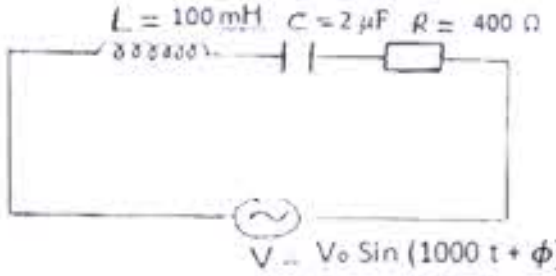
(iii) Identify the materials P and Q.

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

OR

Explain origin of diamagnetism and ferromagnetism.

14. 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.



15. 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'?

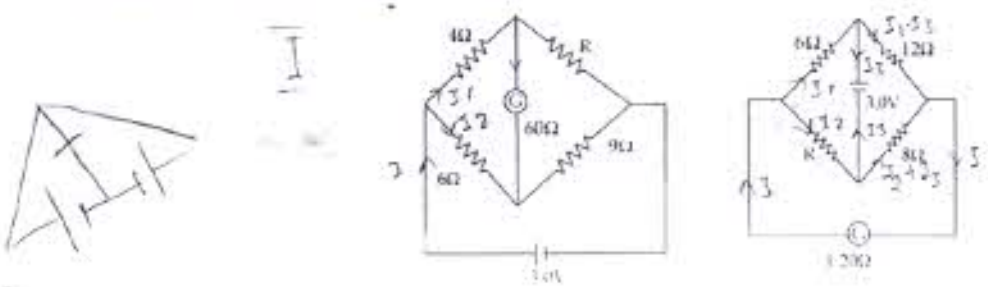
16. State Ampere's circuital theorem and obtain expression of field inside a solenoid.

17. Explain YDSE and obtain value of fringe width.

18. Define rms current. Obtain its expression.

19. Give principle, construction and working of a transformer. Why is its core laminated?

20. The galvanometer, in each of the two given circuits, does not show any deflection. Find the ratio of the resistors R1 and R2, used in these two circuits.



21. Draw ray diagram for an astronomical telescope (normal adjustment). Write its magnification.

22. Two cells of emfs 1.5 V and 2.0 V and internal resistances 2 Ω and 1 Ω respectively have their negative terminals joined by a wire of 6 Ω and positive terminals by a wire of 4 Ω resistance. A third resistance wire of 8 Ω connects middle points of these wires. Draw the circuit diagram. Find the pd across 8 Ω resistance.

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:

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.

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

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 a sphere of radius a having a positively charged point nucleus of charge +Ze at 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 (r<a) from the centre of the atom.

OR

A Dipole is made up of two charges + q and – q separated by a distance 2a.

Derive an expression for the electric field due to this dipole at a point distant r from the centre of the dipole on the equatorial plane.

Draw the shape of the graph, between E and r when r>> a.

If this dipole were to be put in a uniform external electric field E obtain an expression for the torque acting on the dipole.

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.

OR

An a.c. voltage V = Vm sin ωt is applied across an inductor of inductance L.

Obtain expressions for

(iv) the current flowing in the circuit

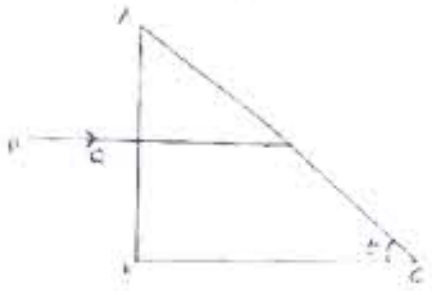
(v) the inductive reactance L

(vi) Hence find the instantaneous power P_i supplied to the inductor.

Show graphically the variation of P_i with ωt.

26. (a) Explain, with the help of a diagram, how is the phenomenon of total internal reflection used in (i) an optical fibre (ii) a prism that inverts an image without changing its size

(b) A right angled prism made from a material of refractive index μ is kept in air. A ray PQ is incident normally on the side AB of the prism as shown.



Find (in terms of μ) the maximum value of θ up to which this incident ray necessarily undergoes total internal reflection at the face AC of the prism.

OR

State Huygens's principle in wave-optics. 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.