Marking Scheme

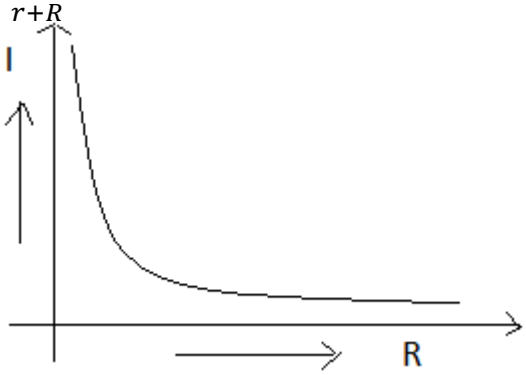
PHYSICS

SAMPLE QUESTION PAPER-2018

Section- A

1. As $V_A - V_B = V_B - V_C$ magnitude of work done is same. (1)

2. $I = \frac{E}{r+R}$



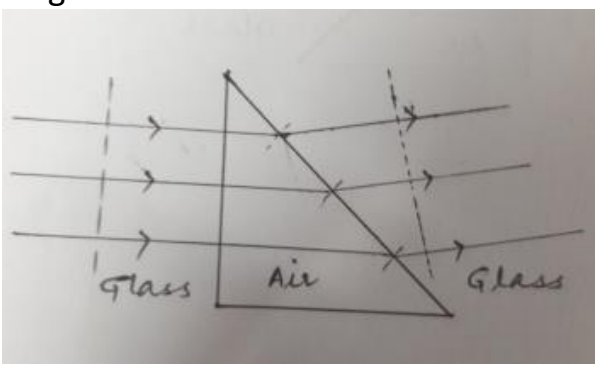
(1)

3. Factors are :

(i) magnetic permeability of the medium (1/2)

(ii) electric permittivity of the medium (1/2)

4. Diagram (1)

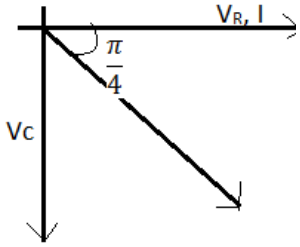


5. In photon picture, intensity is determined by the number of photons crossing per unit time. (1)

Section – B

6. As the current leads the voltage by $\frac{\pi}{4}$, the element used in black box is a 'capacitor'.(½)

(ii) Phasor diagram (½)



tan $\frac{\pi}{4}$ = V_c / V_R
Vc = VR
Xc = R
Impedance Z = $\sqrt{(Xc^2 + R^2)}$ (½)
Z = R$\sqrt{2}$ (½)

7. (i) Energy density u = $\frac{B^2}{\mu_0}$ (½)
u= 11.5 X 10^{-9} J/m^3. (½)

(ii) Speed = $\frac{\omega}{k}$ (½)
speed= 3 X 10^8 m/s (½)

8. $\mu_2/v - \mu_1/u = (\mu_2 - \mu_1)/ R$ (½)
correct sign convention (½)
1.0/v – 1.5/-30 = (1.0 – 1.5) / 20 (½)
v = - 13.3 cm (½)

9. Photodiode (½) Reverse biasing (½)
I-V characteristics NCERT page no. 487 (1)

10.a) need for long antenna diminishes, with explanation (1)
power is inversely proportional to (wavelength)^2 (½),
signals from different transmitters can be distinguished(½)

OR

Range: 76-88 MHz and 420-890 MHz (1)
Factors: by increasing height of transmitting antenna and using repeater stations. (1)

Section- C

11.(a) C = 5 X 10^{-9} F, U = 25 J
U = Q^2/ 2C (½)
Q^2 = 2 U C = 2 X 25 X 5 X 10^{-9}
Q = 5 X 10^{-4} C (½)
Q = n e (½)

n = $\frac{Q}{e}$ = 3.125 X 10^{15} electrons (½)

(b) Without changing charge on the plates, we can make C half. C = $\frac{\varepsilon o\ A}{d}$, i.e. double the plate separation or inserting dielectric of dielectric of a value such that C becomes (1).

12.(a) As the electrostatic field inside a conductor is zero, using Gauss's law,
charge on the inner surface of the shell = -Q (½)
Charge on the outer surface of the shell = +Q (½)

(b) To show using Gauss's law expression
Expression for electric field for radius, r=$\frac{a}{2}$: E = $\frac{1}{4\pi\varepsilon o}\frac{4Q}{a^2}$ (1)
Expression for electric field for radius, r = 2b : E = $\frac{1}{4\pi\varepsilon o}\frac{Q}{4b^2}$ (1)

13. (i) E1 = $\frac{V}{L}$, E2 = $\frac{V}{2L}$, E3 = $\frac{2V}{3L}$ (½)
E2 < E3 < E1 (½)

(ii) V_d α E (½)
V_{d2}< V_{d3}< V_{d1} (½)

(iii) I = nAe V_d / J= σE (½)
J = n e V_d
J2 < J3<J1 (½)

14.NCERT Exemplar Q4.21 R_1, R_2, R_3 (each 1 mark)

15.NCERT pg no. 301 Q6.14 (1 mark each part)

16.Device : Transformer (½)
Diagram on page number 260 NCERT part I (1)
Principle: statement of mutual induction (1)
Efficiency: Assuming no energy losses, the transformer is 100% efficient i.e. $I_pV_p= I_sV_s$. (½)

17.$\beta = \lambda D / d$ (½)
5^{th} bright = $5\beta_1 = 5\lambda_1 D/d = 5 \times 480 \times 10^{-9} \times 2 / 3 \times 10^{-3} = 16 \times 10^{-4}$m (1)
5^{th} bright = $5\beta_2 = 5\lambda_2 D/d = 5 \times 600 \times 10^{-9} \times 2 / 3 \times 10^{-3} = 20 \times 10^{-4}$ m (1)
distance between two 5^{th} bright fringes = $(20 – 16) \times 10^{-4} = 4 \times 10^{-4}$ m (½)

18. 'Light from the sun is unpolarised' means the electric field vector vibrates in all possible directions in the transverse plane rapidly and randomly. (1)

Polarisation of sunlight by the method of scattering: page number 379 of NCERT part II : Diagram + explanation. (1+1)

19. i) Page no. 391 figure 11.4 +explanation (½ +1)

ii) Page no. 392 + explanation (½ + 1)

OR

(i) Davisson- Germer experiment (½)

An electron of charge e, mass m accelerated through a potential difference of v volts, Kinetic energy equals the work done (eV) on it by the electric field:

K = eV (½)

K = $\frac{p^2}{2m}$, p = $\sqrt{(2mk)}$ (½)

p= $\sqrt{(2meV)}$

the de- Broglie wavelength λ of the electron is :

λ = $\frac{h}{p}$ (½)

λ= $\frac{h}{\sqrt{(2meV)}}$ (½)

(ii) For same KE, λ α $\frac{1}{\sqrt{m}}$

As mass of proton is greater than that of electron, ∴ $\lambda_p < \lambda_e$. (½)

20. E = hc / λ = 6.6. x 10^{-34} x 3 x 10^8 / 620 x 10^{-9} (1)

= 3.2 x 10^{-19} J (½)

= 3.2 x 10^{-19} / 1.6 x 10^{-19} = 2 eV (½)

This corresponds to the transition "D" (1)

21. NCERT figure 13.1 on page no. 444 (1)

Fission (1) , Fusion (1)

22.(i) Modulation Index = A_m / A_c = 20/40 = 0.5 (½ + ½)

The side bands are (2000 + 20) KHz

= 2020 KHz and (2000 - 20) KHz

= 1980 KHz (½ + ½)

Amplitude versus ω for amplitude modulated signal : page number 525 NCERT part (ii) Figure 15.9, Ac = 40 volts, $\mu A_c/2$ = 10 volts. (1)

Section -D

23. (a) critical thinking, hard working (1)

(b) One should not touch electrical appliances with wet hands/ any one

precaution. (1)

(c) $I_A = \frac{E}{r+R+R_A}$ (½)

For an ideal ammeter $R_A = 0$

$I = \frac{E}{r+R}$ (½)

Percentage error: $(\frac{I-I_A}{I})$ X 100 = $(\frac{R_A}{R+r+R_A})$ X 100 (1)

Section –E

24. (a) Condition qE = q vB (½)

$v = \frac{E}{B}$ (½)

Trajectory becomes helical about the direction of magnetic field (1)

(b) To derive the expression of magnetic force acting per unit length of the wire:

$\frac{F_m}{l} = \frac{\mu_0 I_1 I_2}{2\pi h}$, upwards on wire AB (2)

At equilibrium Magnetic Force per unit length = mass per unit length X g

$\frac{\mu_0 I_1 I_2}{2\pi h} = \frac{m}{l} g$ (1)

OR

(a) Using the condition $mvr = \frac{nh}{2\pi}$ (1/2)

For H-atom n=1, $v = \frac{h}{2\pi mr}$

Time period $T = \frac{2\pi r}{v}$

$\therefore T = \frac{4\pi^2 mr^2}{h}$, $I = \frac{Q}{T} = \frac{eh}{4\pi^2 mr^2}$ (1/2)

M = I A (1/2)

$M = (\frac{eh}{4\pi^2 mr^2})(\pi r^2)$

$M = \frac{eh}{4\pi m}$ (1/2)

(b) Diagram for magnetic field lines Cu- diamagnetic (1)

Al- Paramagnetic (1)

Fe- Ferromagnetic (1)

25. (a) Diagram (2) + labelling (½)

(b) $m_e = 1 + 25/5 = 6$ (½)

$m_o = 30 / m_e = 5$ (½)

$m_o = v_o / -u_o v_o = - 5 u_o$

$1/f_o = 1/v_o - 1/u_o f_o = - (5/6)\ u_o$ (½)

$u_o = 1.5$ cm , $v_o = 7.5$ cm

$u_e = - 4.17$ cm (½)

Length of the tube = $u_e + v_o = 11.67$ cm (½)

OR

(a) Diagram (2) + labelling (½)

(b) $m = - f_o / f_e$ (½)
$f_o = 5\ f_e$ (½)
$L = f_o + f_e$ (½)
$f_e = 36/6 = 6$ cm (½)
$f_o = 30$ cm (½)

26. (a) circuit diagram (1)
NCERT page no.492 (explanation: 2)

(b) NCERT page no. 511 Q. No.14.17 Logic operation (1) Truth table (1)

OR
Diagram (1 ½)
Input Characteristics (1 ½)
Output Characteristics (1 ½)
Current amplification factor (½)

PHYSICS SQP 2017-18

S.No.	Units	VSA (1 Mark)	SA-I (2 Marks)	SA-II (3 Marks)	Value based (4 Marks)	LA (5 Marks)	Total
1	Electrostatics	1(1) (E)		6(2) A(N)+H			15 (6)
	Current Electricity	1(1) (K)		3(1) E	4(1) (E)		
2	Magnetic Effects of Current & Magnetism			3(1) U		5(1) (A)	16 (5)
	Electromagnetic Induction and Alternating currents		2(1) (U)	6(2) A+U			
3	Electromagnetic Waves	1(1) (H)	2(1) U(N)				17(7)
	Optics	1(1) (H)	2(1) A(N)	6(2) A(N)+U		5(1) (H)	
4	Dual Nature of Matter and Radiation	1(1) (K)		3(1) A			10(4)
	Atoms and Nuclei			6(2) E+K			
5	Electronic devices		2(1) (K)			5(1) (U)	12(4)
	Communication Systems		2(1) A(N)	3(1) U			
	Total	5(5)	10(5)	36(12)	4(1)	15(3)	70(26)

Abbreviations

N(H)	Numerical + HOTS
N (U)	Numerical + Understanding
N (A)	Numerical + Application
K	Knowledge
U	Understanding
A	Application

H	HOTS
EMD	Evaluation and Multi disciplinary

Marks wise weightage to different typology of questions

Typology (Marks)	Number of Questions(Marks)	Marks (questions)
K (7 marks)	3(3) + 4(2)	7(5)
U (21 Marks)	2(1) + 9 (3) +10(2)	21(6)
A (21 Marks)	4(2) +12(4) + 5(1)	21(7)
H (10 Marks)	1(1) + 9(3)	10(4)
EMD (11 Marks)	1(1) + 6 (2) + 4 (1)	11(4)
Total		70 (26)