CLASS : 12th (Sr. Secondary) **3678/3628**

Series : SS-M/2018 ***SET : A, B, C & D***

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MARKING INSTRUCTIONS AND MODEL ANSWERS

PHYSICS

(ACADEMIC/OPEN)

(Only for Fresh/Re-appear Candidates)

उप-परीक्षक मूल्यांकन निर्देशों का ध्यानपूर्वक अवलोकन करके उत्तर-पुस्तिकाओं का मूल्यांकन करें। यदि परीक्षार्थी ने प्रश्न पूर्ण व सही हल किया है तो उसके पूर्ण अंक दें।

General Instructions :

(i) Examiners are advised to go through the general as well as specific instructions before taking up evaluation of the answer-books.

(ii) Instructions given in the marking scheme are to be followed strictly so that there may be uniformity in evaluation.

(iii) Mistakes in the answers are to be underlined or encircled.

(iv) Examiners need not hesitate in awarding full marks to the examinee if the answer/s is/are absolutely correct.

(v) Examiners are requested to ensure that every answer is seriously and honestly gone through before it is awarded mark/s. It will ensure the authenticity as their evaluation and enhance the reputation of the Institution.

(vi) A question having parts is to be evaluated and awarded partwise.

(vii) If an examinee writes an acceptable answer which is not given in the marking scheme, he or she may be awarded marks only after consultation with the head-examiner.

(viii) If an examinee attempts an extra question, that answer deserving higher award should be retained and the other scored out.

(ix) Word limit wherever prescribed, if violated upto 10%. On both sides, may be ignored. If the violation exceeds 10%, 1 mark may be deducted.

(x) Head-examiners will approve the standard of marking of the examiners under them only after ensuring the non-violation of the instructions given in the marking scheme.

(xi) Head-examiners and examiners are once again requested and advised to ensure the authenticity of their evaluation by going through the answers seriously, sincerely and honestly. The advice, if not headed to, will bring a bad name to them and the Institution.

महत्त्वपूर्ण निर्देश :

(i) अंक-योजना का उद्देश्य मूल्यांकन को अधिकाधिक वस्तुनिष्ठ बनाना है। अंक-योजना में दिए गए उत्तर-बिन्दु अंतिम नहीं हैं। ये सुझावात्मक एवं सांकेतिक हैं। यदि परीक्षार्थी ने इनसे भिन्न, किन्तु उपयुक्त उत्तर दिए हैं, तो उसे उपयुक्त अंक दिए जाएँ।

(ii) शुद्ध, सार्थक एवं सटीक उत्तरों को यथायोग्य अधिमान दिए जाएँ।

(iii) परीक्षार्थी द्वारा अपेक्षा के अनुरूप सही उत्तर लिखने पर उसे पूर्णांक दिए जाएँ।

(iv) वर्तनीगत अशुद्धियों एवं विषयांतर की स्थिति में अधिक अंक देकर प्रोत्साहित न करें।

(v) भाषा-क्षमता एवं अभिव्यक्ति-कौशल पर ध्यान दिया जाए।

(vi) मुख्य-परीक्षकों/उप-परीक्षकों को उत्तर-पुस्तिकाओं का मूल्यांकन करने के लिए केवल Marking Instructions/ Guidelines दी जा रही है, यदि मूल्यांकन निर्देश में किसी प्रकार की त्रुटि हो, प्रश्न का उत्तर स्पष्ट न हो, मूल्यांकन निर्देश में दिए गए उत्तर से अलग कोई और भी उत्तर सही हो तो परीक्षक, मुख्य-परीक्षक से विचार-विमर्श करके उस प्रश्न का मूल्यांकन अपने विवेक अनुसार करें।

SET – A

1. (i) (D) **Ans.** ($\because e = -1.6\times10^{-19}C$) 1

(ii) (A) **Ans.** 1

(iii) (A) **Ans.** $\left[\because P = (m/ne^2c)\right]$ 1

(iv) (B) **Ans.** ($I = V/R = 2V/1\times10^3\Omega = 2mA$) 1

(v) (A) **Ans.** ($\phi = 0°$) 1

(vi) (C) **Ans.** $\because V_{rms} = V_0/\sqrt{2}$ 1

(vii) (B) **Ans.** (velocity e. m. w. in vacuum = c) 1

(viii) (C) **Ans.** (Power = $\frac{1}{f} \therefore f = -\frac{1}{4}m = -25\,\text{cm}$) 1

(ix) (C) **Ans.** Polarization 1

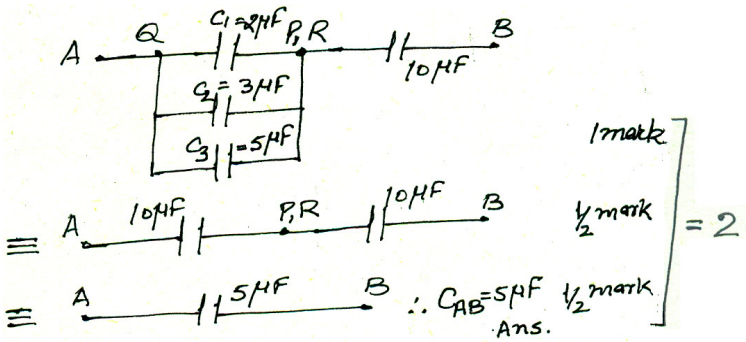
(x) (D) **Ans.** ($\because d_T = \sqrt{2hR} = \sqrt{2\times100\times6400\times10^3}$ m

$= 8\sqrt{20}$ km **Ans.**) 1

(xi) (C) **Ans.** $\left[\because \lambda = \frac{1.227}{\sqrt{V}} nm = \frac{1.227}{11} = 0.112nm\right]$ 1

(xii) (A) **Ans.** ($\because$ No special series in spectrum of hydrogen atom) 1

2. The equivalent circuit of Fig. (Q. No. **2**) is : 2



3. Statement of Kirchhoff's junction rule 1

Sign convention & explanation 1

4. Circuit diagram to determine unknown resistance R. 1

Use of equation $\frac{R}{s} = \frac{l_1}{100 - l_1}$ 1

5. Definition of magnetic permeability $\vec{\mu}$ 1

SI unit TmA^{-1} or NA^{-2}. 1

6. Faraday's law of E.M.I. as $\varepsilon = -\frac{d\phi_\beta}{dt}$ 1

Explanation 1

7. Comparing the give plane E. M. W. with standard equation of wave $B_y = B_0 \sin(kx + \omega t)$. 1

One gets $\omega = 2\pi\upsilon = 1.5 \times 10^{11} \therefore \upsilon = 23.9\,GHz$ **Ans.**

& $k = \frac{2\pi}{\lambda} = 0.5 \times 10^3 m^{-1} \therefore \lambda = 1.26$ cm **Ans.** 1

8. Any ***two*** postulates of Bohr's model 1 + 1 = 2

9. Truth table :

A	Y
0	1
1	0

This is a single input NAND gate. 1

This circuit behaves like NOT gate. 1

10. Definition of modulation 1

Necessity of modulation size of antenna = $\lambda/2$ (very large for 20 kHz of λ = 15 km (say) 1

11. Derivation of expression for $\vec{E} = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{r^2}\hat{r}$ with proper figure. 2 + 1 = 3

12. Angular frequency $\omega_0 = \frac{1}{\sqrt{\alpha c}} = \frac{1}{\sqrt{5\times 80\times 10^{-6}}}$ = 50 rad/s **Ans.** 1

At resonance $Z = R = 20\Omega$ **Ans.** 1

and $I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{220}{20} = 11\text{A}$ **Ans.** 1

13. Definition of interference of light waves 1

Two essential conditions 1 + 1

14. Diagram showing variation of photoelectric current with collector plate potential. 1

Explanation using $h\upsilon = eV_0 + \phi$ 2

15. Graph between P.E. & separation (fig. 13.2 p.445 of text book) 1

Its two main features 1 + 1

16. Moving coil Galvanometer. Principle 1

Circuit for conversion into ammeter 2

Calculation of S by $I_g R_G = (I - I_g)S$. 2

OR

Diagram showing I, B & V in two current carrying conductors. 1

Derivation of $\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{I_1 I_2}{d}$ 3

Definition of 1 Ampere 1

17. Schematic ray diagram 3

Definition of magnifying power 1

& its expression 1

OR

Huygen's construction for reflection of a plane wave by plane surface 3

& Explanation 2

18. Transistor amplifier circuit diagram (fig. 14.32 p. 498 of text book. 3

Working. 2

OR

Transistor characteristics circuit. 3

Sketch of input & output characteristics. 1 + 1

SET – B

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1. (i) (D) **Ans.** γ-rays 1

(ii) (B) **Ans.** ($\because f = \frac{1}{D}m = +\frac{1}{4}m = +25\,cm$) 1

(iii) (D) **Ans.** None of the above 1

(iv) (A) **Ans.** ($\because d_T = \sqrt{2hR}\,m = \sqrt{2\times32\times6400\times10^3}\,m$

$= 6.4\sqrt{10}$ km. **Ans.**) 1

(v) (D) **Ans.** ($\because \lambda = \frac{1.227}{\sqrt{V}}nm = 0.123nm$) 1

(vi) (A) **Ans.** Lyman Ans. 1

(vii) (D) **Ans.** $+1.6\times10^{-19}C$ 1

(viii) (D) **Ans.** four times 1

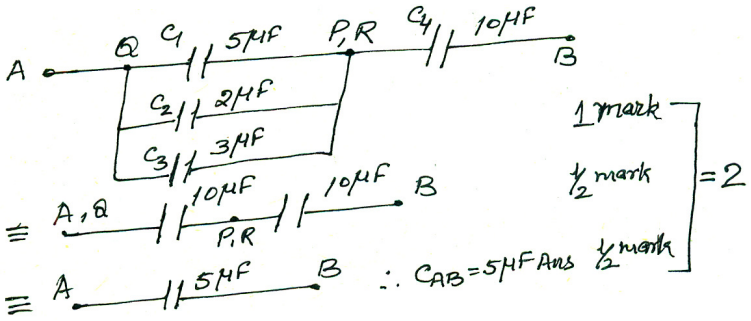
(ix) (B) **Ans.** decreases $\left(\because P = \frac{m}{ne^2\tau}\right)$. 1

(x) (B) **Ans.** $1mA$ $\left(\because I = \frac{V}{R} = \frac{5V}{5\times10^3\,\Omega} = 1mA\right)$ 1

(xi) (B) **Ans.** Zero 1

(xii) (C) **Ans.** $I_0/\sqrt{2}$ $(\because I_{rms} = I_0/\sqrt{2})$ 1

2. The equivalent circuit of Fig. (Q. No. **2**) is : 2



3. Statement of Kirchhoff's loop rule 1

Sign convention & explanation 1

4. Principle of potentiometer $V \alpha\, l$ 1

Circuit diagram 1

5. Definition of magnetic susceptibility χ 1

$\chi = \frac{M}{H}$ is a dimensionless quantity 1

6. Definition of mutual inductance 1

Explanation 1

7. Comparing the given plane E. M. W. with standard equation of wave

$$E_x = E_0 \cos(ky - wt)$$ 1

one gets $w = 2\pi\upsilon = 5.4\times10^6 \therefore \upsilon = 8.6\times10^5 Hz$ **Ans.**

& $k = \frac{2\pi}{\lambda} = 1.8\times10^{-2} \therefore \lambda = 3.5\times10^2$ m **Ans.** 1

8. At the distance of closest approach ≈ size of nucleus 1

K. E. of α-particle = P. E. of α-particle

$$K = \frac{1}{4\pi\in_0}.\frac{(Ze)(2e)}{d}$$

$$\therefore d = \frac{1}{4\pi\in_0}.\frac{2Ze^2}{K}$$ **Ans.** 1

9. This circuit acts like AND gate **Ans.** 1

Truth table of the circuit : 1

A	B	$\overline{A}$	$\overline{B}$	$Y = \overline{\overline{A} + \overline{B}}$
0	0	1	1	0
0	1	1	0	0
1	0	0	1	0
1	1	0	0	1

10. Definition of demodulation 1

& illustrative block diagram 1

11. Derivation of $\vec{E} = \frac{\sigma}{2 \in_0} \hat{n}$ 2

with proper figure 1

12. Angular frequency $w_0 = \frac{1}{\sqrt{\alpha c}} = \frac{1}{\sqrt{8 \times 50 \times 10^{-6}}} =$

50 rad/s 1

At resonance $Z = R = 40\Omega$ **Ans.** 1

and $I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{240}{40} = 6\,\text{A}$ **Ans.** 1

13. Young's double slit experiment : schematic diagram 1

Fringe pattern 1

Intensity distribution 1

14. Einstein's equation $h\upsilon = K.E_{max} + \phi_0$ 1

Definition of threshold frequency 1

& stopping potential 1

15. Law of radioactive decay $\frac{dN}{dt} \alpha - N$ 1

Derivation of $N(t) = N_0 \exp(-\lambda t)$ 2

16. Schematic ray diagram 3

Definition of magnifying power 1

& its expression 1

OR

Definition of wave front 1

Statement of Huygen's principle 2

Construction showing propagation of plane w. f. 2

17. Transistor as a switch : circuit diagram 3

Working 2

OR

CE-Transistor characteristics circuit 3

Sketch of input & output characteristics 1 + 1

18. Principle of M. C. galvanometer 1

Schematic diagram 2

Working of M. C. Galvanometer 2

OR

Principle of use of cyclotron 1+ 1½

Schematic diagram 1

Working 2½

SET – C

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1. (i) (A) **Ans.** OC 1

(ii) (D) **Ans.** Nine times 1

(iii) (B) **Ans.** decreases $\left(\because \mu = \frac{v_d}{E} = \frac{e\tau}{m}\right)$ 1

with rise in temperature, τ decreases

(iv) (B) **Ans.** 2 *mA* $\left(\because I = \frac{V}{R} = \frac{6V}{3\times10^3\Omega} = 2mA\right)$ 1

(v) (A) **Ans.** Zero (P. F. for purely inductive ckt.) 1

(vi) (C) **Ans.** $I_0 / \sqrt{2}$ $(\because I_{rms} = I_0 / \sqrt{2})$ 1

(vii) (B) **Ans.** β-rays 1

(viii) (B) **Ans.** –50 cm. $\left(\because f = \frac{1}{P} = \frac{1}{-2D} = -50\text{cm.}\right)$ 1

(ix) (C) Polarization **Ans.** 1

(x) (C) **Ans.**

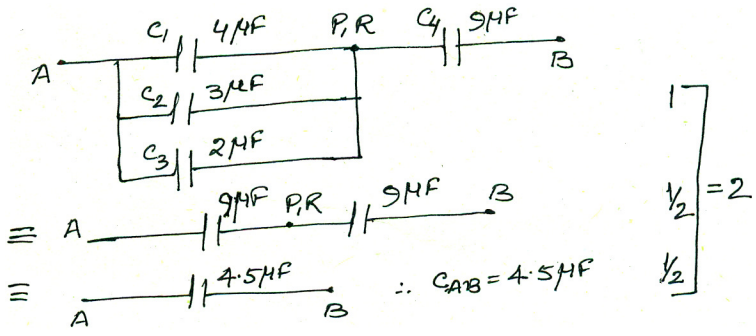
$6.4\sqrt{20}\ km$ $(\because d_T = \sqrt{2hR} = \sqrt{2\times64\times64\times10^5}$ m

$= 6.4\sqrt{20}\ km.)$ 1

(xi) (B) **Ans.** 0.153 nm. $(\because \lambda = \frac{1.227}{N} = 0.153\,\text{nm})$ 1

(xii) (D) **Ans.** Balmer 1

2. The equivalent circuit of Fig. (Q. No. **2**) is : 2



3. Statement of Ohm's law 1

V-I graph & explanation 1

4. Circuit diagram of metrebridge for determination of unknown resistance R. 1

Use of equation $\frac{R}{S} = \frac{l_1}{100 - l_1}$. 1

5. Definition of magnetic intensity $\vec{H}$. 1

SI unit of $H = Am^{-1}$ 1

6. Statement of Lenz's law 1

Explanation 1

7. Comparing the given plane E. M. W. with standard wave equation $B_y = B_0 \sin(kx - \omega t)$ 1

one gets $\omega = 2\pi\upsilon = 1.5 \times 10^{11} \therefore \upsilon = 23.9\,GHz$ **Ans.**

& $k = \frac{2\pi}{\lambda} = 0.5 \times 10^3 m^{-1} \therefore \lambda = 1.26$ cm **Ans.** 1

8. Any ***two*** postulates of Bohr's model 1 + 1 = 2

9. Truth table of given circuit : 1

A	B	$Y = \overline{\overline{AB}}$
0	0	0
0	1	0
1	0	0
1	1	1

This circuit behaves like AND gate **Ans.** 1

10. Definition of modulation 1

Effective power radiated by antenna $P \alpha \ell^2 / \lambda^2$

$\therefore$ P increase with increase in frequency. 1

11. Proper figure for determination of $\vec{E}$ 1

Use of Gauss's law to show $\vec{E} = 0$ 2

12. Angular frequency $\omega_0 = \frac{1}{\sqrt{\alpha c}} = \frac{1}{\sqrt{4 \times 100 \times 10^{-6}}} =$

50 rad/s **Ans.** 1

At resonance $Z = R = 50\Omega$ **Ans.** 1

& current $I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{250}{50} = 5\,A$ 1

13. Definition of coherent sources of light using $y_1 = a\cos \omega t,\ y_2 = a\cos(\omega t + \phi)$ ½

$\therefore y = y_1 + y_2 = \{2a\cos \phi/2\}\cos(\omega t + \phi/2)$ 1½

or $I = 4I_0 \cos^2 \phi/2$.

Condition for constructive & destructive interference. ½ + ½

14. Photoelectric effect & graph of variation of photoelectric current Vs Intensity ½ + ½

Explanation using $h\upsilon$ = K. E_{max} + ϕ_0 2

15. Definition of mass defect & B. E. 1 + 1

Derivation B. E. = $\Delta m.c^2$.

$= \left[\left[Z_{mp} + (A - Z)m_n\right] - M\right]C^2$ 1

16. Diagram showing current I, B & F in two current carrying conductors 1

Derivation of $\frac{F}{l} = \frac{\mu_0}{2\pi}.\frac{I_1 I_2}{\alpha}$ 3

Definition of 1 Ampere 1

OR

Principle of M.C. Galvanometer 1

Circuit showing conversion 2

Calculation of S by $I_g R_G = (I - I_g)S$ 2

17. Huygen's construction for reflection of a plane wave by plane surface 3

& Explanation 2

OR

Schematic ray diagram 3

Definition of magnifying power 1

& its expression 1

18. Transistor amplifier circuit diagram (fig. 14.32 p. 498 of text book 3

Working. 2

OR

Transistor characteristics circuit 3

Sketch of input & output characteristics 1 + 1

1. (i) (B) **Ans.** velocity of x-rays = c 1

(ii) (A) **Ans.** + 50 cm. $\left(\because f = \frac{1}{p} = \frac{1}{2D} = +50\text{cm.}\right)$ 1

(iii) (D) **Ans.** Photoelectric effect 1

(iv) (B) **Ans.** $8\sqrt{10}$ km.

$(\because d_T = \sqrt{2hR} = \sqrt{2\times 50\times 64\times 10^5}\,m$

$= 8\sqrt{10}$ km. **Ans.**) 1

(v) (A) **Ans.** 0.136 nm $(\because \lambda = \frac{1.227}{\sqrt{V}}\text{nm} = 0.136\text{nm}$

Ans.) 1

(vi) (B) **Ans.** Paschen 1

(vii) (A) **Ans.** Zero 1

(viii) (D) **Ans.** 16 times 1

(ix) (A) **Ans.** Increase 1

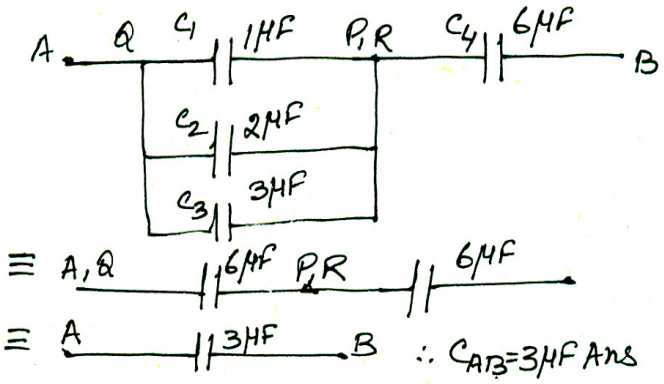
$(\because \mu = \frac{e\tau}{m}, \& \tau$ decreases with temperature)

(x) (C) **Ans.** 0.1A $\left[\because I = \frac{V}{R} = \frac{2V}{20\Omega} = 0.1\text{A}\right]$ 1

(xi) (B) **Ans.** 90° 1

(xii) (A) $I_0/\sqrt{2}$ [$\because I_{rms} = I_0/\sqrt{2}$] **Ans.** 1

2. The equivalent circuit of Fig. (Q. No. **2**) is : 2



1

½

½

3. Statement of Kirchhoff's voltage law 1

Sign convention & explanation 1

4. Circuit diagram of Wheatstone bridge 1

Use of condition $\frac{R_4}{R_3} = \frac{R_2}{R_1}$ for balancing 1

5. Definition for magnetization $\vec{M}$ 1

SI unit $\vec{M} = Am^{-1}$ 1

6. Magnetic flux $\phi_B = \int_S \vec{B}.\overrightarrow{ds}$

SI unit of ϕ_B = Weber. 1

Diagram showing $\phi_B \alpha$ No. of magnetic line. 1

7. Comparing the given plane E. M. W. with standard wave equation $E_x = E_0 \cos(ky + \omega t)$. 1

one gets $\omega = 2\pi\upsilon = 5.4\times10^6 \therefore \upsilon = 8.6\times10^5\ Hz$ **Ans.**

& $k = \frac{2\pi}{\lambda} = 1.8\times10^{-2} m^{-1} \therefore \lambda = 3.5\times10^2$ m **Ans.** 1

8. Figure showing n-standing wave on a circular orbit. 1

$\therefore$ use of $2\pi r_n = n\lambda = \frac{nh}{mv_n}$ to get $mv_n r_n = n\hbar$. 1

9. Truth table of the given circuit is : 1

A	B	$\overline{\overline{A+B}}$
0	0	0
0	1	0
1	0	1
1	1	1

The circuit acts like an OR gate **Ans.** 1

10. Definition of amplitude modulation 1

Diagrams illustrating AM 1

11. Electric flux & Gauss's law $\phi_E = \oint_S \vec{E}.\vec{ds} = \frac{q}{\epsilon_0}$ 2

Main points of this law 1

12. Angular frequency $\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{8\times 50\times 10^{-6}}}$

= 50 rad/s **Ans.** 1

At resonance $Z = R = 30\Omega$ **Ans.** 1

& current $I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = \frac{210}{30} = 7\,A$ 1

13. Definition of diffraction of light waves 1

Diagram showing intensity distribution through single slit & explanation 1 + 1

14. Diagram showing variation of photoelectric current with collector potential for different frequencies. 1

Explanation using $h\upsilon = K_{max} + \phi_0 = eV_0 + \phi_0$ 2

15. Definition of $T_{½}$ & λ 1 + 1

Derivation of $T_{½} = \frac{lnz}{\lambda} = \frac{0.693}{\lambda}$. 1

16. Schematic ray diagram 3

Definition of magnifying power 1

& its expression 1

OR

Definition of wave front 1

Statement of Huygen's principle 2

Construction showing propagation of spherical w. f. 2

17. Circuit diagram of transistor oscillator (fig. 14.33 p. 500 of text book) 3

Working. 2

OR

Simple structure of n-p-n transistor & its biasing (fig. 14.28 p. of textbook) 2

Explanation of transistor action 3

18. Principle of moving coil galvanometer 1

Circuit showing conversion into voltmeter. 2

Calculation of R from $I_g(R_G + R) = V$ 2

OR

Principle of cyclotron 1

Schematic diagram 1

Working 3