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SUBJECT : PHYSICS & CHEMISTRY

Test Booklet Set No.
05

GUJARAT COMMON ENTRANCE TEST (GUJCET) 2019

Date: 26 April, 2019 | Duration: 2 Hours | Max. Marks: 80

:: IMPORTANT INSTRUCTIONS ::

1. The Physics and Chemistry test consists of 80 questions. Each question carries 1 mark. For each correct response, the candidate will get 1 mark. For each incorrect response ¼ mark will be deducted. The maximum marks are 80.
2. This test is of 2 hrs. duration.
3. Use Black Ball Point Pen only for writing particulars on OMR Answer Sheet and marking answer by darkening the circle '•'.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
5. On completion of the test, the candidate must handover the Answer Sheet to the Invigilator in the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
6. The Set No. for this Booklet is **05**. Make sure that the Set No. printed on the Answer Sheet is the same as that on this booklet. In case of discrepancy, the candidate should immediately.
7. The candidate should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet.
8. Do not write you Seat No. anywhere else, except in the specified space in the Test Booklet/Answer Sheet.
9. Use of White fluid for correction is not permissible on the Answer Sheet.
10. Each candidate must show on demand his/her Admission Card to the Invigilator.
11. No candidate, without special permission of the Superintendent or Invigilator, should leave his/her sent.
12. Use of Manual Calculator is permissible.
13. The candidate should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and must sign the Attendance Sheet (Patrak - 01). Cases where a candidate has not signed the Attendance Sheet (Patrak - 01) will be deemed not to have handed over the Answer Sheet and will be dealt with as an unfair means case.
14. The candidates are governed by all Rules and Regulations of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.
15. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
16. The candidates will write the Correct Test Booklet Set No. As given in the Test Booklet/Answer Sheet in the Attendance Sheet. (Patrak - 01)

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PART-I : PHYSICS

1. The dimensional formula of $\sqrt{\mu_r \in_r}$ is________

(A) $M^1L^{-1}T^{-2}A^{-1}$ (B) $M^1L^1T^{-2}A^0$ (C) $M^0L^0T^0A^0$ (D) $M^0L^2T^{-2}A^0$

Ans. (C)

Sol. $v = \frac{1}{\sqrt{\mu_0 \in_0 \mu_r \varepsilon_r}} = \frac{c}{\sqrt{\mu_r \in_r}}$

$\sqrt{\mu_r \in_r} = \frac{c}{v}$ = Dimensionless.

2. At large distances from source $\vec{E}$ and $\vec{B}$ are in phase and the decrease in their magnitude is comparitively slower with distance r as per________

(A) r^{-1} (B) r (C) r^{-3} (D) r^2

Ans. (A)

Sol. For at point source

$I = \frac{P}{4\pi r^2} = \frac{1}{2}\varepsilon_0 E^2 C$

$\Rightarrow \quad E \propto \frac{1}{r}$

3. The angular spread of central maximum, in diffraction pattern, does not depend on_________

(A) the distance between the slit and source (B) width of slit

(C) wavelength of light (D) frequency of light

Ans. (A)

Sol. Angular spread of central maxima is $\theta = 2\lambda/a$.

4. The ratio of resolving power of telescope, when lights of wavelength 4400Å and 5500Å are used, is ____

(A) 16 : 25 (B) 4 : 5 (C) 9 : 1 (D) 5 : 4

Ans. (D)

Sol. Resolving power $\propto \frac{1}{\lambda}$

$\frac{\theta_1}{\theta_2} = \frac{\lambda_2}{\lambda_1} = \frac{5500}{4400} = \frac{5}{4}$

5. In Young's experiment fourth bright fringe produced by light of 5000Å superposes on the fifth bright fringe of an unknown wavelength. The unknown wavelength is _________Å.

(A) 4000 (B) 6000 (C) 5000 (D) 8000

Ans. (A)

Sol. $4\beta_1 = 5\beta_2$

$4 \times 5000 \frac{D}{d} = 5 \times \lambda \frac{D}{d}$

λ = 4000Å

6. IN X-ray tube the potential difference between the anode and the cathode is 20 kV and the current flowing is 1.6 mA. The number of electrons striking the anode in 1s is _________.

(Charge of an electron = 1.6×10^{-19}C)

(A) 10^{14} (B) 1.25×10^{16} (C) 10^{16} (D) 6.25×10^{18}

Ans. **(C)**

Sol. $1.6 \times 10^{-3} = \frac{q}{t}$

$\Rightarrow$ $q = 1.6 \times 10^{-3}$C

$ne = 1.6 \times 10^{-3}$

$n \times 1.6 \times 10^{-19}$

$= 1.6 \times 10^{-3}$

$n = 10^{16}$

7. If the kinetic energy of the electron in the hydrogen atoms is $\frac{e^2}{8\pi \in_0 r}$, then its potential energy is _____.

(A) $\frac{e^2}{4\pi \in_0 r}$ (B) $-\frac{e^2}{4\pi \in_0 r}$ (C) $\frac{e^2}{8\pi \in_0 r}$ (D) $-\frac{e^2}{8\pi \in_0 r}$

Ans. **(B)**

Sol. $\frac{|P.E.|}{2} = K.E.$

P.E. = –2K.E.

$= -2 \times \frac{e^2}{8\pi\varepsilon_0 r} = \frac{-e^2}{4\pi\varepsilon_0 r}$

8. The wavelength of the first line of Lyman series is λ. The wavelength of the first line in Paschen series is _________

(A) 108/7 (B) 27/5 (C) 7/108 (D) 5/27

Ans. **(A)**

Sol. $\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$

$\Rightarrow$ $\frac{1}{\lambda_1} = R\left(\frac{1}{3^2} - \frac{1}{4^2}\right)$

$\Rightarrow$ $\frac{\lambda_1}{\lambda} = \frac{\frac{3}{4}}{\frac{7}{16 \times 9}}$

$\Rightarrow$ $\lambda_1 = \frac{3}{4} \times \frac{16 \times 9}{7}\lambda$

$\Rightarrow$ $\lambda_1 = \frac{108}{7}\lambda$

9. For a radioactive element, τ = ______ $\tau_{1/2}$.

(A) 0.693 (B) 693 (C) 144 (D) 1.44

Ans. **(D)**

Sol. $T_{mean} \times \ell n\ 2 = T_{1/2}$

$T_{mean} = T_{1/2}(1/\ell n2)$

$=1.44T_{1/2}$

10. For the following nuclear disintegration process ${}^{238}_{92}U \rightarrow {}^{206}_{82}Pb + x[{}^{4}_{2}He] + [{}^{0}_{-2}e]$ then value of x is_____.

(A) 8 (B) 6 (C) 4 (D) 10

Ans. **(A)**

Sol. Mass should be conserved

238 = 206 + 4x + 0

x = 32/4 = 8

11. If the radii of ${}^{64}_{30}Zn$ and ${}^{27}_{13}Al$ nuclei are R_1 and R_2 respectively then $\frac{R_1}{R_2}$ = _______.

(A) $\frac{64}{27}$ (B) $\frac{4}{3}$ (C) $\frac{3}{4}$ (D) $\frac{27}{64}$

Ans. **(B)**

Sol. $R \propto A^{1/3}$

$$\frac{R_1}{R_2} = \left(\frac{64}{27}\right)^{1/3} = \frac{4}{3}$$

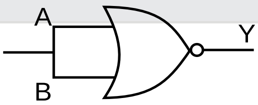
12. For PN junction, the intensity of electric field is 1×10^6 V/m and the width of depletion region is 5000Å. The value of potential barrier = ________V.

(A) 0.05 (B) 0.005 (C) 0.5 (D) 5

Ans. **(C)**

Sol. $V = Ed = 10^6 \times 5 \times 10^{-7} = 0.5V$

13. The logic circuit in the figure represents characteristics of which logic gate ?



(A) NOR (B) OR (C) NAND (D) NOT

Ans. **(D)**

Sol.

Input	Output
0	1
1	0

14. For PN junction, the width of space charge region is approximately____ μm.

(A) 0.5 (B) 6 (C) 5 (D) 0.05

Ans. **(A)**

Sol.

15. A modulating signal of frequency 5 kHz and peak voltage of 8V is used to modulate a carrier of frequency 10 MHz and peak voltage 10V. Then the amplitude of USB is _____V.

(A) 3 (B) 4 (C) 2 (D) 5

Ans. **(B)**

Sol. $\frac{\mu A_C}{2} = \frac{A_m}{A_C} \times \frac{A_C}{2} = \frac{A_m}{2} = \frac{8}{2} = 4V$

16. The propagation of radio waves with frequency 2 MHz to 30 MHz is due to _____.

(A) Space wave (B) Optical fibre (C) Ground wave (D) Sky wave

Ans. **(D)**

Sol.

17. When two spheres having 4Q and –2Q charge are placed at a certain distance, the force acting between them is F. Now they are connected by a conducing wire and again separated from each other. Now they are kept at a distance half of the previous one. The force acting between them is ____.

(A) F (B) F/4 (C) F/2 (D) F/8

Ans. **(C)**

Sol. $F = \frac{K(4Q)(2Q)}{r^2} = \frac{8KQ^2}{r^2}$

$F' = \frac{K(Q)(Q)}{\left(\frac{r}{2}\right)^2} = \frac{4KQ^2}{r^2}$

18. Charge of 1μC each is placed on the five corners of a regular hexagon of side 1m. The electric field at its centre is _____ N/C

(A) $\frac{5}{6} \times 10^{-6}K$ (B) 5×10^{-6} K (C) $\frac{6}{5} \times 10^{-6}K$ (D) 10^{-6} K

Ans. **(D)**

Sol. Electric field at centre due to five charges is equal to E.F due to one charge

$E = \frac{KQ}{r^2}$

$= \frac{K \times (10^{-6})}{1^2} = 10^{-6}K$

19. An electric dipole is placed in a non-uniform electric field, then_______

(A) The resultant force acting on the dipole is always zero

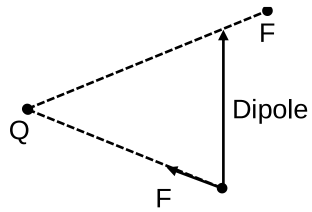
(B) Torque acting on it may be zero

(C) The resultant force acting on the dipole may be zero

(D) Torque acting on it is always zero.

Ans. **(B)**

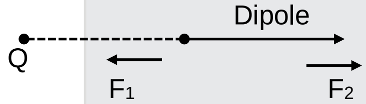
Sol. (i)



$F_{net} \neq 0$

$\tau_{net} \neq 0$

(ii)



$F_{net} \neq 0$

$\tau_{net} = 0$

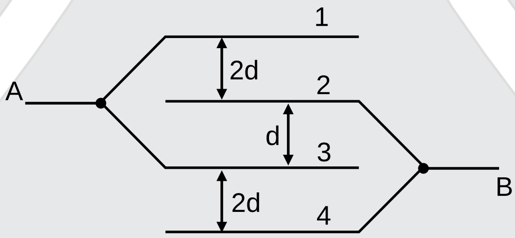
20. The unit of intensity of polarization is______.

(A) C/m^2 (B) C^2/m^2 (C) C^2/m (D) m^2/C

Ans. **(A)**

Sol. $I = \frac{\text{Dipolemoment}}{\text{volume}} = \frac{Cm}{m^3} = \frac{C}{m^2}$

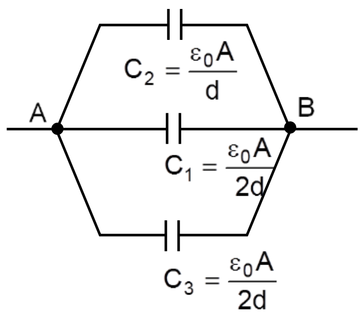
21. In the figure area of each plate is A and the distance between consecutive plates is as shown in the figure. What is the effective capacitance between points A & B



(A) $\frac{A\varepsilon_0}{d}$ (B) $\frac{3A\varepsilon_0}{d}$ (C) $\frac{2A\varepsilon_0}{d}$ (D) $\frac{4A\varepsilon_0}{d}$

Ans. **(C)**

Sol.



$C_{eq} = \frac{\varepsilon_0 A}{d} + \frac{\varepsilon_0 A}{2d} + \frac{\varepsilon_0 A}{2d} = \frac{2\varepsilon_0 A}{d}$

22. A moving positive charge approaches a negative charge. What will happen to the potential energy of the system ?

(A) will remain constant (B) will decrease (C) will increase (D) may increase or decrease

Ans. **(B)**

Sol. $U = \frac{K(q_1)(-q_2)}{r}$

$r\downarrow \Rightarrow U\downarrow$

23. The heat produced per unit time, on passing electric current through a conductor at a given temperature, is directly proportional to the______.

(A) Electric current (B) Reciprocal of electric current

(C) Square of electric current (D) Reciprocal of square of electric current

Ans. **(C)**

Sol. $P = I^2R$

24. A carbon resistor has three bands as brown, black and green in order. What will be the range of resistance it offers.

(A) $7 \times 10^5\,\Omega - 13 \times 10^5\,\Omega$ (B) $9 \times 10^5\,\Omega - 11 \times 10^5\,\Omega$

(C) $8 \times 10^5\,\Omega - 12 \times 10^5\,\Omega$ (D) None of these

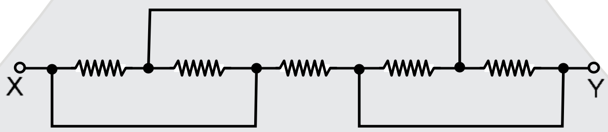
Ans. **(C)**

Sol. $R = (10 \times 10^5) \pm 20\%$

$R_{min} = 8 \times 10^5\Omega$

$R_{max} = 12 \times 10^5\Omega$

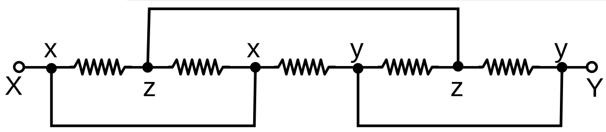
25. In the network shown in the figure the equivalent resistance between points X& Y will be ______Ω. Value of each resistance is 2Ω.

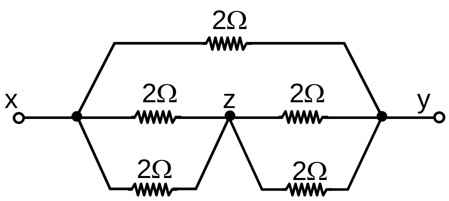


(A) 2 (B) 4 (C) 1 (D) 2/3

Ans. **(C)**

Sol.





$R_{xy} = 1\Omega$

26. Shunt wire should be ______.

(A) Thick and long (B) Thick and short (C) Thin and long (D) Thin and short

Ans. (B)

Sol. Shunt should have low resistance

$R = \frac{\rho \ell}{A}$

ℓ should be less

A should be large

27. The dimensional formula of effective torsional constant of spring is______.

(A) $M^1L^2T^{-3}$ (B) $M^1L^2T^{-2}A^{-2}$ (C) $M^1L^2T^{-2}$ (D) $M^0L^0T^0$

Ans. (C)

Sol. $\tau = C\theta$

$C = \tau/\theta$

$C \equiv [ML^2T^{-2}]$

28. There are 50 turns per cm length in a very long solenoid. It carries a current of 2.5A. The magnetic field at its centre on the axis is ______T.

(A) $5\pi \times 10^{-3}$ (B) $6\pi \times 10^{-3}$ (C) $2\pi \times 10^{-3}$ (D) $4\pi \times 10^{-3}$

Ans. (A)

Sol. $B = \mu_0 ni = 4\pi \times 10^{-7} \times \frac{50}{10^{-2}} \times 2.5$

$= 5\pi \times 10^{-3}$

29. The gyromagnetic ratio of an electron = ______ specific charge of an electron.

(A) 1 (B) 2 (C) 1/2 (D) 4

Ans. (C)

Sol. Ratio = q/2m = 1/2 × specific charge

30. Alnico is an alloy of ______

(A) Ai, Ni, Cu, P (B) Al, Ni, Cu, Co (C) Al, Ni, As, P (D) Al, As, P, Pt

Ans. (B)

31. The focal length of a thin lens made from the material of refractive index 1.5 is 15 cm. When it is placed in a liquid of refractive index 4/3, its focal length will be______ cm.

(A) 80.31 (B) 50 (C) 78.23 (D) 60

Ans. (D)

Sol. $\frac{1}{15} = (1.5-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{f} = \left(\frac{1.5}{4/3} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{f}{15} = \frac{1/2}{(1/8)}$

f = 4 × 15 = 60 cm

32. Time taken by the sunlight to pass through a slab of 4 cm and refractive index 1.5 is____ sec.

(A) 2×10^{-8} (B) 2×10^{-11} (C) 2×10^{-10} (D) 2×10^{11}

Ans. (C)

Sol. $t = \frac{d}{v} = \frac{dn}{c} = \frac{4\times10^{-2}}{3\times10^{8}} \times \frac{3}{2}$

$t = 2 \times 10^{-10}$ sec.

33. If the tube length of astronomical telescope is 96 cm and magnifying power is 15 for normal setting, then the focal length of the objective is _____ cm.

(A) 100 (B) 90 (C) 105 (D) 92

Ans. (B)

Sol. $|m| = \frac{f_0}{f_e} = 15$

$f_0 = 15\, f_e$

tube length = $f_0 + f_e = 96$

$15f_e + f_e = 96$

$f_e = 6$ cm

$f_0 = 15 \times 6 = 90$ cm

34. Photons of energy 2eV and 2.5eV successively illuminate a metal whose work function is 0.5 eV. The ratio of maximum speed of emitted electron is ________.

(A) $\sqrt{3} : 2$ (B) 2 : 1 (C) 1 : 2 (D) $2 : \sqrt{3}$

Ans. (A)

Sol. $K.E_{max} = h\nu - \phi$

$\frac{1}{2}mv^2 = h\nu - \phi$

$\frac{v_1^2}{v_2^2} = \frac{2-0.5}{2.5-0.5} = \frac{1.5}{2} = \frac{3}{4}$

$\frac{v_1}{v_2} = \frac{\sqrt{3}}{2}$

35. To increase de-Broglie wavelength of an electron from 0.5×10^{-10} m to 10^{-10} m, its energy should be ______.

(A) increased to 4 times (B) halved (C) doubled (D) decreased to fourth part

Ans. (D)

Sol. $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}}$

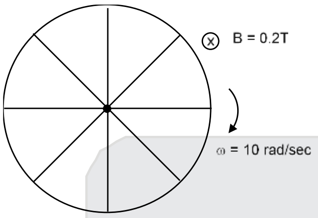
$\lambda \to 2\lambda. \quad \Rightarrow \quad K \to \frac{K}{4}$

36. A wheel of radius 2m having 8 conducting concentric spokes is rotating about its geometrical axis with an angular velocity of 10 rad/s in a uniform magnetic field of 0.2T perpendicular to its plane. The value of induced emf between the rim of the wheel and centre is ______V

(A) 2 (B) 6 (C) 4 (D) 8

Ans. **(C)**

Sol.



$$\varepsilon = \frac{1}{2} B\omega R^2$$

$$\varepsilon = \frac{1}{2} \times 0.2 \times (10)(2)^2 = 0.1 \times 4 \times 10 = 4V$$

37. A coil of surface area 200 cm^2 having 25 turns is held perpendicular to the magnetic field of intensity 0.02 Wb/m^2. The resistance of the coil is 1Ω. If it is removed from the magnetic field in 1s, the induced charge in the coil is_______ C.

(A) 1 (B) 0.01 (C) 0.1 (D) 0.001

Ans. **(B)**

Sol. $q = \frac{\phi_i - \phi_f}{R} = \frac{NBA}{R} = \frac{25 \times 0.02 \times 200 \times 10^{-4}}{1}$

$= 25 \times 2 \times 2 \times 10^{-4}$

$= 10^{-2} C = 0.01C$

38. The dimensional formula of JWL is ______. Take Q as the dimension of charge.

(A) $M^{-1}L^{2}T^{-1}Q^{-2}$ (B) $M^{-1}L^{-2}T^{-1}Q^{-2}$ (C) $M^{1}L^{2}T^{-1}Q^{-2}$ (D) $M^{1}L^{2}T^{1}Q^{-2}$

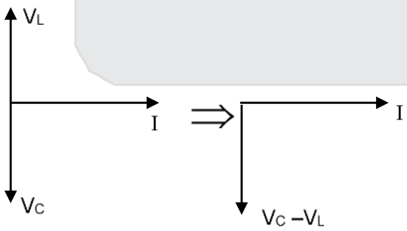
Ans. **( )**

39. If in an A.C., L-C series circuit $X_C > X_L$. Hence potential______.

(A) lags behind the current by $\pi/2$
(B) leads the current by π in phase
(C) leads the current by $\pi/2$ in phase
(D) lags behind the current by π in phase.

Ans. **(A)**

Sol. **Phasor diagram**



Potential lags by $\pi/2$ phase

40. In L-C-R, A.C. series circuit, L = 9 H, R = 10Ω & C = 100μF. Hence Q-factor of the circuit is _____.

(A) 25 (B) 45 (C) 35 (D) 30

Ans. **(D)**

Sol. $Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{\omega_0 L}{R}$

$$Q = \frac{1}{10}\sqrt{\frac{9}{100 \times 10^{-6}}} = \frac{3}{10 \times 10^{-2}} = 30$$