MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY DABWALI ROAD, BATHINDA

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PET-2017 (Physics- Faculty of Sciences)

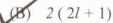
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- 1. Bohr radius is of the order of
 - (A) 10^{-10}
 - (B) 10^{-14} cm
 - (C) 10^{-12} cm 10^{-8} cm
- 2. Which of the following is Hermitian Operator
 - (A) *ix*
 - (B) ∂



- (D) it
- The commutator $\left[\frac{d}{dx}, x\right]$ gives
 - (A) i
 - (B) -1
 - (C)
 - (B) 1
- 4. The total number of electrons in a subshell with orbital quantum number 'l' is
 - (A) l(l+1)



- (C) $2l^2$
- (D) 2(l+1)
- 5. Eigen values of hermitian operator are
 - (A) always imaginary
 - (B) always zero
 - always real
 - (D) not observable



- 6. In an *n-p-n* transistor biased for operation in forward active region
 - (A) Base is positive both with respect to emitter and collector base is positive with respect to emitter and collector is positive with respect to base
 - (C) collector is positive with respect to base
 - (D) emitter is positive with respect to base
- 7. A particular green LED emits light of wavelength 5490, Å, the energy bandgap of the semiconductor material used there is . (Given $h = 6.6 \times 10^{-34} \,\text{J sec}$).
 - (A) 1.98 eV
 - (B) 0.74 eV
 - 2.26 eV
 - (D) 1.17 eV
- 8. In a degenerate *n* type semiconductor material, the Fermi level
 - (A) is very near valence band
 - (B) is at the centre in between valence and conduction bands
 - (C) is in valence band
- is in conduction band
- 9. A triangular-wave oscillator can be realized using an op-amp comparator based rectangular wave generator followed by
 - (A) Differentiator
 - (B) amplifier
 - integrator
 - (D) Multivibrator
- 10.

 A 12 bit ADC is used to convert analog voltage of 0 to 10 V into digital. The resolution is
 - (M 2.44 mV
 - (B) 24.4 mV
 - (C) 1.2 V
 - (D) 39.2 mV
- 11. $\overline{\overline{AB} + \overline{AC}}$ is equivalent to
 - (A) A + B + C
 - (B) ABC
 - (C) ABC
 - (D) ABC



- (A)
- (B) 12.2
- 22.2 (C)
- (D) 17.3
- 13. According to Maxwell's law of distribution of velocities of molecules, the most probable velocity is
 - Greater than the mean velocity (A)
 - Equal to the mean velocity (B)
 - Less than the root mean square velocity
 - Equal to root mean square velocity
- Transverse magnetic (TM) waves have 14.
 - magnetic field component H in the direction of propagation (A)
 - electric field component E in the direction of propagation (B)
 - magnetic field component H in the direction of propagation and no component of (C) electric field E in this direction
 - electric field component E in the direction of propagation and no component of magnetic field H in this direction
- 15. The Laplace transform function f(t) is F(s), then Laplace transform of its first derivative w.r.t. 't' is
 - (A) s F(s) + f(0)
 - (B) s F(s)
 - s F(s) f(0)
 - (D) $s^2 F(s) f(0)$
- The primary cosmic rays consist of 16.
 - (A) pions, muons, electrons and neutrons
 - about 92% protons, rest are deuterons, alpha particles and heavier nuclei.
 - muons and electrons
 - ¹⁴C nuclei (D)
- 17. The character of the $3^- \rightarrow 0^+$ gamma transition is
 - (A) magnetic octupole
 - (B) magnetic dipole
 - electric quadrupole

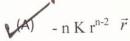




- uud
- (B) uuu
- (C) udd
- (D) ddd
- 19. The plot of the second order Legendre polynomial $P_2(\cos \theta)$ is
 - (A) Symmetric about x-axis

Symmetric about x-axis as well as y-axis

- (C) Symmetric about y-axis
- (D) Constant
- 20. Force associated with the potential energy $U = K r^n$ is



- (B) $-n K r^{n-1} \vec{r}$
- (C) n K r^{n-2} \vec{r}
- (D) $n K r^{n-1} \vec{r}$
- 21. The spin state of electrons in the ground state of Helium
 - (A) Spin doublet
 - (B) Orbital triplet
 - (C) Spin triplet
 - Spin singlet
- 22. Natural shape of the energy distribution in an atomic transition is
 - (A) Gaussian

(B) Lorenzian

- (C) Maxwellian
- (D) Poisson
- 23. Vacuum of the order of 10⁻⁶ torr can be produced and measured using
 - (A) adsorption pump and thermocouple gauge, respectively.

diffusion pump and penning gauge, respectively.

- (C) diffusion pump and pirani gauge, respectively.
- (D) rotary pump and pirani gauge, respectively.



- (A) the recoiling nucleus and β particle are emitted in one direction, and the antineutrino moves in the opposite direction.
- (B) the recoiling nucleus moves in a direction out of the plane of emission of the β -particle and antineutrino.
- (C) the recoiling nucleus, β particle and neutrino are emitted in a plane. the recoiling nucleus, β particle and antineutrino are emitted in a plane.
- 25. According to the liquid drop model, the volume energy, surface energy and Coulomb energy (a₁, a₂ and a₃ being positive constants) contributions to binding energy are
 - (A) a_1A , $-a_2A^{1/3}$ and $-a_3Z(Z-1)A^{-2/3}$, respectively.
 - (B) a_1A , $a_2A^{2/3}$ and $-a_3Z^2(Z-1)A^{-1/3}$, respectively.
 - (C) a_1 , $-a_2A^{1/3}$ and $-a_3Z^2A^{-1/3}$, respectively.
 - a_1A_1 , $-a_2A^{2/3}$ and $-a_3Z(Z-1)A^{-1/3}$, respectively.
- 26. The Gell Mann Nishijima formulae relate
 - (A) the nuclear isospin data.
 - (B) $\pi^+ n$, $\pi^0 p$ scattering amplitude
 - mass splitting in hadron multiplets.
 - (D) the masses of leptons in the standard model.
- 27. At the interface between a dielectric and free space
 - (A) Tangential components of D and B are continuous
 - (B) Normal component of D and tangential component of B are continuous
 - (C) Normal components of D and B are continuous
 - Tangential component of D and normal component of B are continuous
- 28. Consider a system of two identical bosons, each of which can be in any one of three single particle states. The number of possible states of the system is
 - MAY 6
 - (B) 9
 - (C) 3
 - (D) 1
- 29. The effective mass of a photon of wavelength 1 Å is
 - (A) Zero
 - (8) 2.2 x 10⁻²² kg
 - (C) 1.2 x 10⁻¹⁵ kg
 - (D) $2.1 \times 10^{-15} \text{ kg}$



30. Which of the following is invariant under Lorentz transformations?

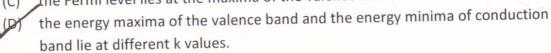
- (A) Three dimensional volume element dx dy dz
 Four dimensional volume element dx dy dz dt
- (C) $\left[p \frac{E}{c^2}\right]$
- (D) $\left[p^2 \frac{E}{c^2}\right]$

31. Which of the following is non-central force?

- (A) Gravitational force
- (B) Coulomb force
- Nuclear force
- (D) None of above

32. In an indirect semiconductor

- (A) the energy maxima of the valence band and the energy minima of conduction band lie at same k values.
- (B) the Fermi level lies in the conduction band
- (C) the Fermi level lies at the maxima of the valence band



33. Which of the following is a conservative force

$$(A) yz \hat{\imath} + zx \hat{\jmath} + xy \hat{k}$$

- (B) $yz \hat{\imath} zx \hat{\jmath} + xy \hat{k}$
- (C) $y^2 \hat{i} + x^2 \hat{j} + z^2 \hat{k}$
- (D) $yz \hat{\imath} zx \hat{\jmath} xy \hat{k}$

34. Fourier transform of $\cos \omega_o t$ is

(A)
$$\pi[\delta(\omega+\omega_o)-\delta(\omega-\omega_o)]$$

(B)
$$\pi[\delta(\omega+\omega_o)+\delta(\omega-\omega_o)]$$

- (C) $j\pi[\delta(\omega+\omega_o)-\delta(\omega-\omega_o)]$
- (D) $j\pi[\delta(\omega-\omega_o)-\delta(\omega+\omega_o)]$



35. The Lagrangian in case of a relativistic one-dimensional (x) harmonic oscillator is given by $(\beta = v/c)$

(A)
$$L = -mc^{2}\sqrt{1-\beta^{2}} - \frac{1}{2}kx^{2}$$

$$L = -mc^{2}\sqrt{1-\beta^{2}} - \frac{1}{2}kx^{2}$$

$$CC) \qquad L = -mc^{2}\sqrt{1-\beta^{2}} - \frac{1}{2}kx^{2}$$

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- 36. The energy of the incident proton required to produce antiproton by the reaction is $p+p\to p+p+p+\ \overline{p}\ \ \text{is at least}$
 - (A) 1.876 GeV
 - (B) 5.57 MeV
 - (C) 938 MeV

(D) 5.57 GeV

- 37. Amplitude modulated wave of message signal m(t) = B $\cos \omega_m t$ modulated on carrier signal A $\cos \omega_c t$ is represented by
 - (A) A [1+($A\omega_m/B\omega_c$) cos $\omega_m t$]
 - (B) $A \cos \omega_c t + B \cos \omega_m t$

A [1+(B/A) $\cos \omega_m t$] $\cos \omega_c t$

(D) A $[\cos^2 \omega_c t + (B/A) \cos^2 \omega_m t]$

- 38. Ionic solids with Schottky defects contain in their structures
 - (A) cation vacancies and interstitial cations.
 - (B) interstitial anions and anion vacancies
 - (C) _cation vacancies only

equal number of cation and anion vacancies

- 39. Body diagonal of a cube is 866 pm. Its edge length would be
 - (A) 600 pm

(8) 500 pm

- (C) 1000 pm
- (D) 408 pm
- 40. The value of integral $\int_0^1 x^3 \delta(x-2) dx$ is Zero
 - (A) Zero (B) 3
 - (C) -3
 - (D) 5

