

Code No.

J – 2278

**Entrance Examination for Admission to the P.G. Courses in the Teaching
Departments, 2020**

**CSS
PHYSICS**

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General Instructions

1. The Question Paper is having two Parts — Part 'A' Objective type (60%) & Part 'B' Descriptive type (40%).
2. Objective type questions which carry 1 mark each are to be (✓) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part 'B'.
4. **Negative marking** : 0.25 marks will be deducted for each wrong answer in Part 'A'.

Time : 2 Hours

Max. Marks : 100

To be filled in by the Candidate

Register Number	in Figures								
	in words								

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**PART – A
(Objective Type)**

Choose appropriate answer from the options in the questions. **One mark each.**

(60 × 1 = 60 marks)

1. Vectors which are confined to the same plane are called

a) Coplanar vector	b) Null vector
c) Negative vector	d) Collinear vector

DO NOT WRITE HERE

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2. Photoelectric effect can be explained by
- a) Wave nature of light
 - b) Particle nature of light
 - c) Both wave nature and particle nature of light
 - d) None of the above
3. In photoelectric effect the electrons are ejected from the
- a) Inner shell
 - b) Surface
 - c) From the core
 - d) The nucleus

4. The energy of a photon depends on its
- | | |
|----------------|--------------|
| a) Amplitude | b) Velocity |
| c) Temperature | d) Frequency |
5. The Bohr quantum condition for a stable atom is
- | | |
|-------------------|------------------|
| a) $L = nh/2$ | b) $L = nh/2\pi$ |
| c) $L = 2\pi h/n$ | d) $L = \pi h/n$ |
6. The charge of an electron was first measured in
- Cathode ray experiment by J.J. Thomson
 - Photoelectric effect experiment
 - Millikan's oil drop experiment
 - Electron diffraction by aluminium foil
7. The transformation of coordinates of an event in one inertial frame of reference to another inertial frame of reference is called
- | | |
|----------------------------|----------------------------|
| a) Galilean transformation | b) Newton's transformation |
| c) Newton's second law | d) Cartesian coordinates |
8. Moment of linear momentum is
- | | |
|------------------|-----------------|
| a) $r \times mv$ | b) $r \times m$ |
| c) $r \times v$ | d) $r/m v$ |
9. Colour in a soap bubble or in an oil slick on the road are caused by
- | | |
|---------------------------|---------------------------|
| a) Diffraction | b) Polarization |
| c) Thin film interference | d) Light intensity change |
10. A liquid opposes relative motion between its layers due to
- | | |
|--------------------|--------------|
| a) Surface tension | b) Viscosity |
| c) Elasticity | d) Diffusion |

11. Which one of the following objects, moving at the same speed, has the greatest de Broglie wavelength?
- a) Neutron
 - b) Electron
 - c) Tennis ball
 - d) Alpha particle
12. Freezing point of Mercury is
- a) -39°C
 - b) -29°C
 - c) 0°C
 - d) -77°C
13. $C_p - C_v =$
- a) Q/J
 - b) R/J
 - c) Q/R
 - d) R/Q
14. The number of microstates in a macrostate is called
- a) Thermal frequency
 - b) Thermodynamic frequency
 - c) Statistical frequency
 - d) Any of the above
15. Hamiltonian is given by
- a) $T + V$
 - b) $T - V$
 - c) T/V
 - d) V/T
16. Lagrangian is given by
- a) $T + V$
 - b) $T - V$
 - c) T/V
 - d) V/T
17. The bending of waves around the edges of obstacles is called
- a) Interference
 - b) Polarization
 - c) Refraction
 - d) Diffraction

18. A light beam spreads out when it travels through a narrow slit. Which of the following can explain this phenomenon?
- | | |
|-----------------|----------------|
| a) Polarization | b) Reflection |
| c) Refraction | d) Diffraction |
19. Plane of polarization and plane of vibration are
- | | |
|--------------------------------|---------------------------|
| a) Perpendicular to each other | b) Parallel to each other |
| c) Straight | d) None of the above |
20. Ruby red is a crystal of
- | | |
|--------------|--------------|
| a) Al^{3+} | b) Cr^{3+} |
| c) AlO | d) Al_2O_3 |
21. Acoustic holography is used in
- | | |
|----------------------------|----------------------|
| a) Non-destructive testing | b) Fiber optics |
| c) Optics | d) None of the above |
22. Numerical aperture is given by
- | | |
|--------------------|----------------------------|
| a) n_1^2 | b) n_2^2 |
| c) $n_1^2 - n_2^2$ | d) $(n_1^2 - n_2^2)^{1/2}$ |
23. Optical fibre acts as
- | | |
|---------------|-------------------|
| a) Wave guide | b) Optical pulses |
| c) Sender | d) Receiver |
24. Plastics are
- | | |
|-------------|---------------------|
| a) Crystals | b) Amorphous solids |
| c) Metals | d) Non-metals |
25. Band gap energy of silicon is
- | | |
|-----------|-----------|
| a) 1.3 eV | b) 1.8 eV |
| c) 1.1 eV | d) 2 eV |

26. Magnetic susceptibility is given by
- a) I/H
 - b) H/I
 - c) HI
 - d) $1/HI$
27. Mass defect is
- a) Difference between the total mass of nucleons and mass of the nucleus
 - b) Sum of the masses of all nucleons
 - c) Sum of the masses of nucleons and electrons
 - d) Difference between mass of protons and mass of neutrons
28. If ΔM is the mass defect, the binding energy is
- a) $\Delta M/c^2$
 - b) $\Delta M + c^2$
 - c) ΔMc^2
 - d) ΔM
29. A nuclear power station works on
- a) Controlled nuclear fission
 - b) Uncontrolled nuclear fission
 - c) Controlled nuclear fusion
 - d) Uncontrolled nuclear fusion
30. 1 amu = _____
- a) 1.66×10^{-27} kg
 - b) 2.66×10^{-27} kg
 - c) 1.5×10^{-27} kg
 - d) 1.2×10^{-27} kg
31. A semiconductor diode is used as
- a) Oscillator
 - b) Amplifier
 - c) Rectifier
 - d) Resistor
32. Zinc is an example of
- a) Conductor
 - b) Insulator
 - c) Semi-conductor
 - d) Dielectric

33. An oscillator employs
- a) Positive feedback
 - b) Negative feedback
 - c) No feedback
 - d) Both positive and negative feedback
34. The open loop gain of an OPAMP is
- a) Infinity
 - b) Zero
 - c) One
 - d) Any of the above
35. SCR is a solid state equivalent of
- a) Diode
 - b) Triode
 - c) Pentode
 - d) Thyatron
36. Bistable multivibrator is also called
- a) Sinusoidal oscillator
 - b) Amplifier
 - c) Square wave oscillator
 - d) Flip-flop
37. 8086 is a
- a) 16 bit microprocessor
 - b) 8 bit microprocessor
 - c) 4 bit microprocessor
 - d) 64 bit microprocessor
38. Program written in 8085 microprocessor is
- a) Assembly language
 - b) Low level language
 - c) High level language
 - d) Machine language
39. A rod of proper length l_0 moves with a velocity $0.8 c$. The length of the rod in motion is
- a) $0.5 l_0$
 - b) l_0
 - c) $0.6 l_0$
 - d) $0.06 l_0$

40. The wavelength of matter wave is given by
- | | |
|--------------------|--------------------|
| a) $\lambda = h$ | b) $\lambda = p$ |
| c) $\lambda = h/p$ | d) $\lambda = p/h$ |
41. A simple pendulum is taken to moon where the gravity is only 1/6 times of that of earth. If the period of the pendulum on the earth is T, what is the period on the moon?
- | | |
|-----------------------|--------|
| a) T | b) T/2 |
| c) $\sqrt{6} \cdot T$ | d) 6 T |
42. The moment of inertia does not depend on
- | | |
|---------------------|---------------------|
| a) Mass | b) Axis of rotation |
| c) Angular velocity | d) Shape |
43. A geostationary satellite revolves around the earth from
- | | |
|-------------------|-------------------|
| a) East to West | b) West to East |
| c) North to South | d) South to North |
44. Internal energy of an ideal gas depends on
- | | |
|-------------|-------------------|
| a) Pressure | b) Temperature |
| c) Volume | d) Molecular size |
45. For a harmonic oscillator the zero point energy is
- | | |
|-------------------|-----------------------|
| a) $\hbar \omega$ | b) $1/2 \hbar \omega$ |
| c) 0 | d) $3/2 \hbar \omega$ |
46. The surface temperature of a star is determined using
- | | |
|-----------------|-------------------|
| a) Planck's law | b) Wien's law |
| c) Stefan's law | d) Kirchoff's law |

47. The Boolean expression $\bar{A}\bar{B} + \bar{A} + AB$ is equivalent to
- | | |
|--------|--------------|
| a) A | b) \bar{A} |
| c) 1 | d) 0 |
48. A solid sphere rolls on a horizontal plane. The ratio of its rotational kinetic energy to its total kinetic energy is
- | | |
|------------|------------|
| a) $1 : 7$ | b) $2 : 7$ |
| c) $3 : 7$ | d) $4 : 7$ |
49. A Carnot engine is working between temperatures T_1 and T_2 . The efficiency will be maximum for the maximum value of
- | | |
|----------------------|----------------------|
| a) $(T_1 + T_2)/T_1$ | b) $(T_1 - T_2)/T_1$ |
| c) $(T_1 + T_2)/T_2$ | d) $(T_1 - T_2)/T_2$ |
50. The I-V characteristics of an ideal PN diode is
- | | |
|--------------|----------------|
| a) Parabolic | b) Exponential |
| c) Linear | d) Zig-Zag |
51. The mass of proton is _____ times that of an electron.
- | | |
|---------|----------|
| a) 1000 | b) 430 |
| c) 1837 | d) 10000 |
52. Fermions are particles with spin =
- | | |
|----------|----------|
| a) $1/2$ | b) 0 |
| c) 1 | d) $3/2$ |
53. Electrons follow _____ statistics.
- | | |
|----------------------|----------------------|
| a) Maxwell-Boltzmann | b) Fermi-Dirac |
| c) Bose-Einstein | d) None of the above |

54. The integral form of Gauss's law is

a) $\oint B \cdot dS = \frac{q_{\text{enclosed}}}{\epsilon_0}$

b) $\nabla \cdot B = \frac{\rho}{\epsilon_0}$

c) $\nabla \times B = \frac{\rho}{\epsilon_0}$

d) $\nabla \times E = \frac{\rho}{\epsilon_0}$

55. Reciprocal lattice of bcc lattice is

a) bcc itself

b) fcc

c) hcp

d) none of these

56. The electric field and potential are related by the equation

a) $E = \nabla^2 V$

b) $E = -\nabla V$

c) $E = \nabla V$

d) $E = V$

57. The order of magnitude of the energy gap of a typical super conductor is

a) 1 MeV

b) 1 KeV

c) 1 eV

d) 1 meV

58. In Raman spectrum, the intensity of Stokes lines will be normally _____ compared to anti-Stokes lines.

a) More

b) Less

c) Equal

d) Can be anything

59. Canonical transformations are the transformations of

a) Phase space

b) Minkowski space

c) Hilbert space

d) None of these

60. Poisson and Lagrange brackets are _____ under Canonical Transformation.

a) Convergent

b) Divergent

c) Invariant

d) Variant

ANSWER SHEET — PART — A

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E

21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E
25	A	B	C	D	E
26	A	B	C	D	E
27	A	B	C	D	E
28	A	B	C	D	E
29	A	B	C	D	E
30	A	B	C	D	E
31	A	B	C	D	E
32	A	B	C	D	E
33	A	B	C	D	E
34	A	B	C	D	E
35	A	B	C	D	E
36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E
40	A	B	C	D	E

41	A	B	C	D	E
42	A	B	C	D	E
43	A	B	C	D	E
44	A	B	C	D	E
45	A	B	C	D	E
46	A	B	C	D	E
47	A	B	C	D	E
48	A	B	C	D	E
49	A	B	C	D	E
50	A	B	C	D	E
51	A	B	C	D	E
52	A	B	C	D	E
53	A	B	C	D	E
54	A	B	C	D	E
55	A	B	C	D	E
56	A	B	C	D	E
57	A	B	C	D	E
58	A	B	C	D	E
59	A	B	C	D	E
60	A	B	C	D	E

PHYSICS

PART – B (Descriptive Type)

Answer **any eight** questions.

(8 × 5 = 40 Marks)

1. Define moment of inertia. Give the formula, units and dimensions of moment of inertia.
2. State and explain Newton's law of cooling.
3. Derive an equation for electric potential due to a dipole.
4. Define first order phase transition and derive the Clausius-Clapperon equation.
5. Derive Poisson's and Laplace's equation.
6. Deduce Kepler's laws of planetary motion.
7. Derive expression for relativistic variation of length with velocity.
8. Derive time dependent Schrodinger equation from first principles.
9. Explain liquid drop model of nucleus and explain fission using this model.
10. With the help of a diagram, explain the working of a D-type flip-flop.
11. State Biot-Sawart law, and derive an expression for the magnetic field due to current passing through a long conductor.
12. Explain the principle of a hologram. Explain the processes involved in the construction of a hologram.

