Mock Test-2 (Engineering Entrance)

The following mock test been prepared keeping in mind all the mojor competitive exams, that is, AIEEE, AIPMT and IIT-JEE which enables students to understand the methodology use in various types of questions and thereby enhancing their competitive skills.

Single Correct Choice Type

Each question has four choices (a), (b), (c) and (d) out of which ONLY ONE is correct.

1. The fossil bone has $^{14}C : ^{12}C$ ratio which is $\frac{1}{16}$ of that in a living animal's bone. If half life time of ^{14}C is 5730 years, then the age of fossil bone is

(a) 11460 years (b) 17190 years

(c) 22920 years (d) 45840 years.

2. If ε_0 and μ_0 represent the permittivity and permeability of vacuum and ε and μ represent the permittivity and permeability of medium, the refractive index of the medium is given by

(a) $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$ (b) $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$

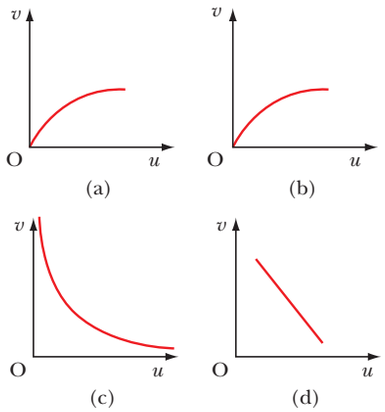
(c) $\sqrt{\frac{\varepsilon}{\mu_0\varepsilon_0}}$ (d) $\sqrt{\frac{\mu_0\varepsilon_0}{\varepsilon}}$

3. A photo-cell is illuminated by a source of light, which is placed at a distance d from the cell. If the distance becomes $d/2$, then number of electrons emitted per second will be

(a) one-fourth (b) two times

(c) four times (d) remains the same.

4. A convex mirror has a focal length f. A real object is placed at a distance f in front of it from the pole. The mirror produces an image at



(a) Infinity (b) f

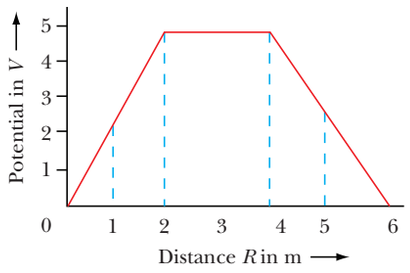
(c) $f/2$ (d) $2f$

5. Two concentric coils each of radius equal to 2π cm are placed at right angles to each other. 3 A and 4 A are the currents flowing in each coil respectively. The magnetic induction in Wb/m^2 at the centre of the coils will be ($\mu_0 = 4\pi \times 10^{-7}$ Wb/Am)

(a) 12×10^{-5} (b) 10^{-5}

(c) 5×10^{-5} (d) 7×10^{-5}

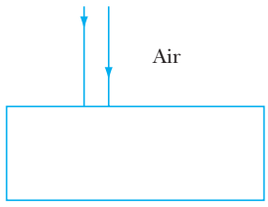
6. The variation of potential with distance R from fixed point is shown in figure. The electric field at $R = 5$ m is



(a) 2.5 volt/m (b) –2.5 volt/m

(c) 2/5 volt/m (d) –2/5 volt/m

7. A parallel beam of light of intensity I_0 is incident on a glass plate, 25% of light is reflected by upper surface and 50% of light is reflected from lower surface. The ratio of maximum to minimum intensity in interference region of reflected rays is:



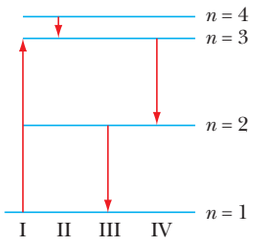
(a) $\left(\frac{\frac{1}{2}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$ (b) $\left(\frac{\frac{1}{4}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$

(c) $\frac{5}{8}$ (d) $\frac{8}{5}$

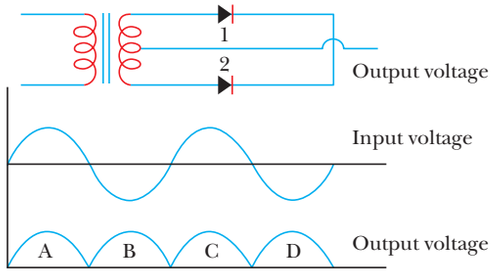
8. The diagram shows that energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy?

(a) I (b) II

(c) III (d) IV



9. A full wave rectifier circuit along with the input and output voltage is shown in figure:



The contribution of output voltage from diode-2 is

(a) A, B (b) B, D

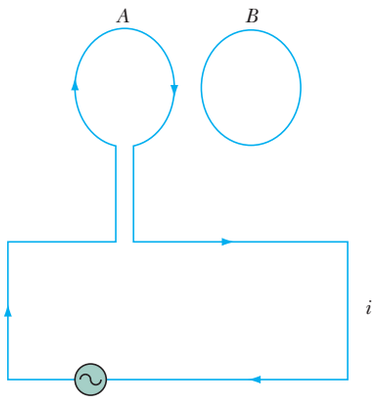
(c) B, C (d) A, D

10. A magnetic needle lying parallel to a magnetic field requires W units of work to turn it through 60°. The torque required to maintain the needle in this position will be

(a) $\sqrt{3}W$ (b) W

(c) $\frac{\sqrt{3}}{2}W$ (d) $2W$

11. Two circular coils A and B are facing each other as shown in figure. The current i through A can be altered.



(a) There will be repulsion between A and B if i is increased

(b) There will be attraction between A and B if i is increased

(c) There will be neither attraction nor repulsion when i is changed.

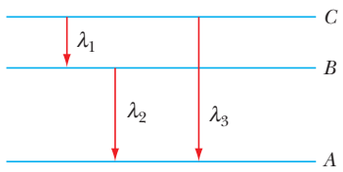
(d) Attraction or repulsion between A and B depends on the direction of current. It does not depend whether the current is increased or decreased

12. Magnetic field intensity at the centre of coil of 50 turns, radius 0.5 m and carrying a current of 2 A is

(a) 0.5×10^{-5} T (b) 1.25×10^{-4} T

(c) 3×10^{-5} T (d) 4×10^{-5} T

13. Energy levels A, B, C of a certain atom corresponding to increasing values of energy, *i.e.*, $E_A < E_B < E_C$. If λ_1, λ_2, λ_3 are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statements is correct



(a) $\lambda_3 = \lambda_1 + \lambda_2$ (b) $\lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

(c) $\lambda_1 + \lambda_2 + \lambda_3 = 0$ (d) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

Multiple Correct Choice Type

Each question has four choices (a), (b), (c) and (d) out of which ONE OR More may be correct.

14. The maximum range of ground or surface wave propagation depends upon

(a) The frequency of the wave

(b) The power of the transmitter

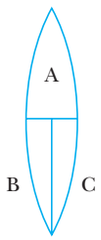
(c) The size of the transmitter

(d) All of the above

15. A thin, symmetric double-convex lens of power P is cut into three parts A, B and C as shown. The power of

(a) A is P (b) A is $2P$

(c) B is $\frac{P}{2}$ (d) B is $\frac{P}{4}$



16. An A.C. source producing $V = V_0 \sin\omega t + V_0 \sin 2\omega t$ is connected in series with a box containing either capacitor or inductor and resistance. The current found in the circuit is $i = i_1 \sin(\omega t + \phi_1) + i_2 \sin(2\omega t + \phi_2)$. Here ϕ_1, and ϕ_2 may be positive or negative.

(a) if $i_1 > i_2$, box has inductor and resistor

(b) if $i_1 > i_2$, box has capacitor and resistor

(c) if $i_2 > i_1$, box has inductor and resistor

(d) if $i_2 > i_1$, box has capacitor and resistor

17. An electron is excited from a lower energy state to a higher energy state in a hydrogen atom. Which of the following quantity/quantities decreases/decrease in the excitation?

(a) Potential energy (b) Angular speed

(c) Kinetic energy (d) Angular momentum

18. In a Young's double slit experiment, the separation between the two slits is d and the wavelength of the light is λ. The intensity of light falling on the slit 1 is four times the intensity of light falling on slit 2. Choose the correct choice(s).

(a) If $d = \lambda$, the screen will contain only one maximum.

(b) If $\lambda < d < 2\lambda$, at least one more maximum (besides the central maximum) will be observed on the screen.

(c) If the intensity of light falling on the slit 1 is reduced, so that it becomes equal to that of the slit 2, the intensities of the observed dark and bright fringes will increase.

(d) If the intensity of light falling on the slit 2 is increased, so that it becomes equal to that of the slit 1, the intensities of the observed dark and bright fringes will increase.

19. Radioactivity –

(a) is an exoergic process

(b) is an endoergic process

(c) can be produced artificially

(d) cannot be produced artificially

20. When photon of energy 4.25 eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy T_A eV and de-Broglie wavelength λ_A. The maximum kinetic energy of photoelectrons liberated from another metal B by photon of energy 4.70 eV is $T_B = (T_A - 1.50)$ eV. If the de-Broglie wavelength of these photoelectrons is $A_B = 2\lambda_A$, then

(a) The work function of A is 2.25 eV

(b) The work function of B is 4.20 eV

(c) $T_A = 2.00$ eV

(d) $T_B = 2.75$ eV

Assertion–Reason Type

In the following set of questions, two statements "Assertion" and "Reason" are given. Choose the correct answer from the following options:

(a) Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

(b) Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.

(c) Assertion is true but the Reason is false.

(d) Assertion and Reason both are false.

21. **Assertion:** The colour of light emitted by a LED depends on its forward biasing.

Reason: The reverse biasing of p-n junction will lower the width of depletion layer.

22. **Assertion:** When two lenses in contact form an achromatic doublet, then the material of the two lenses are always different.

Reason: The dispersive powers of the materials of the two lenses are of opposite sign.

23. **Assertion:** The force of repulsion between atomic nucleus and α-particle varies with distance according to inverse square law.

Reason: Rutherford did α-particle scattering experiment.

24. **Assertion:** The divisions are equally marked on the scale of ac ammeter.

Reason: Heat produced is directly proportional to the current.

25. **Assertion:** In Young's double slit experiment, the fringe width for dark fringes is different from that for white fringes.

Reason: In Young's double slit experiment performed with a source of white light, only black and bright fringes are observed.

26. **Assertion:** The de-Broglie wavelength of a molecule varies inversely as the square root of temperature.

Reason: The root mean square velocity of the molecule depends on the temperature.

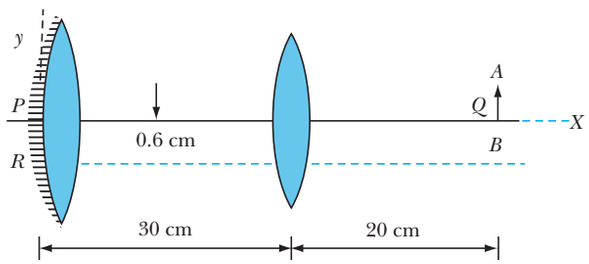
27. **Assertion:** A dish antenna is highly directional.

Reason: This is because a dipole antenna is omni-directional.

28. **Assertion:** Bohr had to postulate that the electrons in stationary orbits around the nucleus do not radiate.

Reason: According to classical physics all moving electrons radiate.

Paragraph for questions 29, 30 and 31 A convex lens of focal length 15 cm and a concave mirror of focal length 30 cm are kept with their optic axes PQ and RS parallel but separated in the vertical direction by 0.6 cm as shown. The distance between the lens and mirror is 30 cm. An upright object AB of height 1.2 cm is placed on the optic axis PQ of the lens at a distance 20 cm from the lens and the reflection from the mirror,



29. Find the location of image $A'B'$ from the pole of the mirror

(a) $x = 5$ cm (b) $x = 10$ cm

(c) $x = 15$ cm (d) $x = 20$ cm

30. The magnification of the imager $A'B'$ will be

(a) 0.5 (b) 0.1

(c) 1 (d) 2.3

31. For the same problem as above, the height of the image will be

(a) 2.3 cm (b) 0.73 cm

(c) 1.8 cm (d) –2.9 cm

Paragraph for questions 32, 33 and 34 A beam of alpha particles is incident on a target of lead. A particular alpha particle comes in "head-on" to a particular lead nucleus and stop 6.50×10^{-14} m away from the center of the nucleus. (This point is well outside the nucleus). Assume that the lead nucleus which has 82 protons, remains at rest. The mass of alpha particle is 6.64×10^{-27} kg.

32. Calculate the electrostatic potential energy at the instant that the alpha particle stops

(a) 36.3 MeV (b) 45.0 MeV

(c) 3.63 Me V (d) 40.0 Me V

33. What initial kinetic energy (in joules and in MeV) did the alpha particle have

(a) 36.3 (b) 0.36

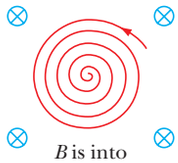
(c) 3.63 (d) 2.63

34. What was the initial speed of the alpha particle

(a) 132×10^2 m/s (b) 132×10^7 m/s

(c) 13.2×10^2 m/s (d) 0.13×10^7 m/s

Paragraph for questions 35, 36 and 37 Figure shows the trace of the path of a charged particle in a bubble chamber. Assume that the magnetic field is into the plane of the paper, with magnitude 0.4 T. The smooth spiral path occurs because the particle loses energy in ionizing molecules along the path.



B is into the page

35. Which of the statements is true regarding kinetic energy of the particle during motion in spiral path.

(a) Kinetic energy of the particle is maximum at outer part of the spiral

(b) Kinetic energy of the particle is maximum at inner part of the spiral

(c) Kinetic energy of the particle first decreases then increases during motion.

(d) Kinetic energy of the particle remains constant during motion along spiral path.

36. Regarding nature of the charge we can conclude

(a) The charge is negative

(b) The charge is positive

(c) The particle have no charge

(d) No conclusion can be make regarding nature of charge.

37. The radius of curvature ranges from 70 to 10 mm. What is the range of values of the magnitude of momentum (p) if the magnitude of the charge is e?

(a) $8e \times 10^{-2}$ kg m/s $\le p \le 28e \times 10^{-3}$ kg m/s

(b) $4e \times 10^{-2}$ kg m/s $\le p \le 28e \times 10^{-3}$ kg m/s

(c) $10e \times 10^{-2}$ kg m/s $\le p \le 23e \times 10^{-3}$ kg m/s

(d) $5e \times 10^{-2}$ kg m/s $\le p \le 20e \times 10^{-3}$ kg m/s

Paragraph for questions 38, 39, 40, 41 and 42 A piece of pure semiconductor of silicon of size 1 cm × 1 cm × 1 mm is having 5×10^{28} number of atoms per cubic metre. It is doped, simultaneously with 5×10^{22} atoms per m^3 of arsenic and 5×10^2 per m^3 atoms of indium. The number density of intrinsic current carrier (electrons and holes) in the pure silicon semiconductor is $1.5 \times 10^{16}\ m^{-3}$. Mobility of electrons is 3800 $cm^2\ V\ s^{-1}$.

Answer the following questions:

38. The number of electrons in this semiconductor are

(a) 5.0×10^{15} (b) 4.95×10^{15}

(c) 4.95×10^{22} (d) 25×10^{22}

39. The number of holes in this semiconductor are

(a) 5.0×10^{20} (b) 4.54×10^{13}

(c) 4.54×10^{9} (d) 4.54×10^{2}

40. Total number of current carriers in this semiconductor are

(a) 5×10^{15} (b) 5.05×10^{22}

(c) 4.95×10^{15} (d) 4.95×10^{22}

41. The conductivity of doped semiconductor (in Sm^{-1}) is

(a) 2×10^3 (b) 3×10^3

(c) 4×10^3 (d) 1×10^3

42. Ratio of conductivity of doped silicon and pure silicon semiconductor is

(a) 2.2×10^6 (b) 3.3×10^6

(c) 2.2×10^8 (d) 3.3×10^8

Matrix Match Type

43. In Boolen algebra if the level of $A = 1$ and of $B = 0$, then match the results of column I with that of column II

Column-I		Column-II	
(A)	$(A \cdot B) + A$	(p)	A
(B)	$(A + \bar{B}) \cdot A$	(q)	B
(C)	$(\bar{A} + B) \cdot A$	(r)	$(A + B)$
(D)	$(A + \bar{B}) + (B \cdot \bar{A})$	(s)	$(A \cdot B)$

44.

Column-I		Column-II	
(A)	concave mirror	(p)	virtual, erect, smaller image
(B)	convex mirror	(q)	real, inverted, smaller image
(C)	convex lens	(r)	virtual, erect, larger image
(D)	concave lens	(s)	real, inverted, larger image

45.

Column-I		Column-II	
(A)	Interference	(p)	Corpuscular theory
(B)	Compton effect	(q)	Longitudinal waves
(C)	Diffraction	(r)	Transverse waves
(D)	Polarization	(s)	Dual theory

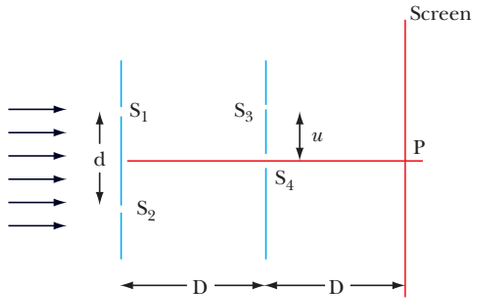
46. A series *RLC* circuit is driven by an alternating source at a frequency of 400 Hz and an emf amplitude of 90.0 V. The resistance is 20.0 Ω, the capacitance is 12.1 μF, and the inductance is 24.2 mH.

Column-I		Column-II	
(A)	rms potential across resistor	(p)	60.9
(B)	rms potential across capacitor	(q)	37
(C)	rms potential across inductor	(r)	113
(D)	average power of the circuit	(s)	68.6

Integer Type

47. A thin prism of angle 6° made of glass of refractive index 1·5 is combined with another prism made of glass of μ = 1·6 to produce dispersion without deviation. The angle of second prism is:

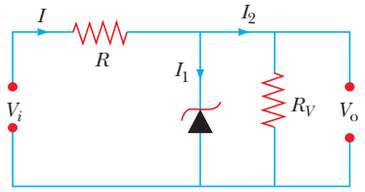
48. In the arrangement shown wavelength of light used is λ. The distance between slits S_1 and S_2 is d $(<<D)$. The distance between S_3 and S_4 is $u=\frac{\lambda D}{3d}$. If the ratio of maximum to minimum intensity observed on screen is k. Find k.



49. When a beam of 10.6 eV photons of intensity to W/m^2 falls on platinum surface of area 1.0×10^{-4}m^{2}and work function 5.6 eV, 0.53% of incident photon eject photoelectrons. If the number photoelectrons emitted per second is 6250 × 10x, then find x.

50. A neutron with kinetic energy K = 10 MeV activates an endoergic nuclear reaction $n+{}^{12}_{6}C\rightarrow{}^{9}_{4}Be+{}^{4}_{2}He$. Initially ${}^{12}_{6}C$ was at rest. The threshold energy of this reaction is 6.5 MeV. Find the kinetic energy of the α-particle (in MeV) going at right angle to the direction of the incoming neutron.

51. A 10 V zener diode along with a series resistance R is connected across a 40 V supply, If the maximum value zener current is 50 mA, the minimum value of resistance R is $a\times10^2\ \Omega$. Find the integer value of a.



52. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coils is given by $\phi=\phi_0+4t$, where ϕ is in webers, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is

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1. (c)
2. (b)
3. (c)
4. (c)
5. (c)
6. (a)
7. (a)
8. (c)
9. (b)
10. (a)
11. (a)
12. (b)
13. (b)
14. (a, b)
15. (a, c)
16. (a, d)
17. (a, c)
18. (a, b)
19. (a, c)
20. (a, b, c)
21. (d)
22. (c)
23. (b)
24. (d)
25. (d)
26. (a)
27. (b)
28. (d)
29. (c)
30. (a)
31. (c)
32. (c)
33. (c)
34. (b)
35. (a)
36. (b)
37. (b)
38. (b)
39. (d)
40. (c)
41. (b)
42. (b)
43. ((A-*p*, *r*; B-*p*, *r* ; C-*q*, *s* ; D-*p*, *r*))
44. ((A-*q*, *r*, *s*; B-*p*; C-*q*, *r*, *s* ; D-*p*))
45. ((A-*q*, *r*, *s* ; B-*p*, *s*; C-*q*, *r*, *s* ; D-*r*, *s*))
46. ((A) → q, (B) → p, (C) → r, (D) → s)
47. (5°)
48. (9)
49. (8)
50. (2 eV)
51. (6)
52. (120 V)