

Topic : **Full Syllabus**

Time: 75 Min Marking: +4 -1

Section - A: MCQs with Single Option Correct

1. Let l , R , C and V represent inductance, resistance, capacitance and voltage, respectively. The dimension of $\frac{ICV}{R}$

in SI units will be :

[DPYQ From 2019]

- (A) $[LTA]$ (B) $[LA^{-2}]$
(C) $[AT^2]$ (D) $[LT^2]$

2. An automobile, travelling at 40 km/h, can be stopped at a distance of 40 m by applying brakes. If the same automobile is travelling at 60 km/h, the minimum stopping distance, in metres, is (assume no skidding) :

[DPYQ From 2018]

- (A) 75 m (B) 160 m
(C) 100 m (D) 90 m

3. A butterfly is flying with a velocity $4\sqrt{2}$ m/s in North-East direction. Wind is slowly blowing at 1 m/s from North to South. The resultant displacement of the butterfly in 4 seconds is :

[DPYQ From 2021]

- (A) $12\sqrt{2}$ m (B) 15 m
(C) 3 m (D) 20 m

4. A disc rotates about its axis of symmetry in a horizontal plane at a steady rate of 1.75 revolutions per second. A coin placed at a distance of 1 cm from the axis of rotation remains at rest on the disc. The coefficient of friction between the coin and the disc is ($g = 10 \text{ m/s}^2$) :

[DPYQ From 2018]

- (A) 0.5 (B) 0.7
(C) 0.12 (D) 0.6

5. A body of mass 3 kg makes an elastic collision with a second body at rest and continues to move in the original direction but with one fourth of its original speed. What is the mass of the second body ?

[DPYQ From 2019]

- (A) 1.8 kg (B) 1.2 kg
(C) 1.5 kg (D) 2.0 kg

6. A rocket has to be launched from earth in such a way that it never returns. If E is the minimum energy delivered by the rocket launcher, what should be the minimum energy that the launcher should have if the same rocket is to be launched from the surface of the moon ? Assume that the density of the earth

and the moon are equal and that the earth's volume is 60 times the volume of the moon :

[DPYQ From 2019]

- (A) $\frac{E}{4}$ (B) $\frac{E}{16}$
(C) $\frac{E}{32}$ (D) $\frac{E}{15}$

7. Young's moduli of two wires A and B are in the ratio 6 : 5. Wire A is 5 m long and has radius R . Wire B is 1.5 m long and has radius 1 mm. If the two wires stretch by the same length for a given load, then the value of R is close to :

[DPYQ From 2019]

- (A) 1.9 mm (B) 1.80 mm
(C) 1.5 mm (D) 1.66 mm

8. When the temperature of a metal wire is increased from 0°C to 20°C , its length increases by 0.02 %. The percentage change in its mass density will be closest to :

[DPYQ From 2020]

- (A) 0.008 (B) 0.06
(C) 0.8 (D) 2.3

9. Consider a mixture of n moles of helium gas and $3n$ moles of oxygen gas (molecules taken to be rigid) as an ideal gas. Its C_p/C_v value will be :

[DPYQ From 2020]

- (A) 67/45 (B) 19/13
(C) 13/9 (D) 40/27

10. Two moles of helium gas is mixed with two moles of hydrogen molecules (taken to be rigid). What is the molar specific heat of mixture at constant volume ? ($R = 8.3 \text{ J/mol K}$):

[DPYQ From 2019]

- (A) 16.62 J/mol K (B) 19.7 J/mol K
(C) 17.4 J/mol K (D) 15.7 J/mol K

11. Equation of travelling wave on a stretched string of linear density 5 g/m is $y = 0.03 \sin(450t - 5x)$ where distance and time are measured in SI units. The tension in the string is :

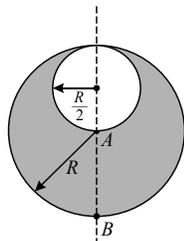
[DPYQ From 2019]

- (A) 10 N (B) 12.5 N
(C) 40.5 N (D) 5 N

12. Consider a sphere of radius R which carries a uniform charge density ρ . If a sphere of radius $\frac{R}{2}$ is carved out of it, as shown,

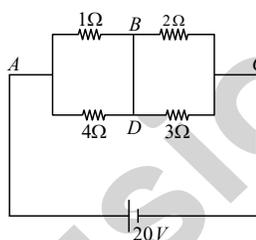
the ratio $\left| \frac{\vec{E}_B}{\vec{E}_A} \right|$ of magnitude of electric field \vec{E}_A and \vec{E}_B ,

respectively, at points A and B due to the remaining portion is :
[DPYQ From 2020]



- (A) $\frac{18}{54}$ (B) $\frac{21}{34}$
(C) $\frac{17}{9}$ (D) $\frac{18}{34}$

13. In the given circuit diagram, a wire is joining points B and D . The current in this wire is :
[DPYQ From 2020]



- (A) 4 A (B) 2 A
(C) 0.4 A (D) Zero

14. A current of 1.5 A is flowing through a triangle, of side 9 cm each. The magnetic field at the centroid of the triangle is : (Assume that the current is flowing in the clockwise direction)
[DPYQ From 2021]

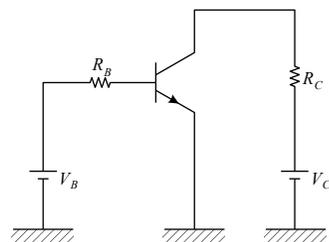
- (A) $2\sqrt{3} \times 10^{-7}$ T, outside the plane of triangle
(B) 3×10^{-7} T, outside the plane of triangle
(C) $2\sqrt{3} \times 10^{-5}$ T, inside the plane of triangle
(D) 3×10^{-5} T, inside the plane of triangle

15. At an angle of 60° to the magnetic meridian, the apparent dip is 45° . Find the true dip :
[DPYQ From 2021]

- (A) $\tan^{-1} \frac{\sqrt{3}}{2}$ (B) $\tan^{-1} \frac{1}{2}$
(C) $\tan^{-1} \sqrt{3}$ (D) $\tan^{-1} \frac{2}{\sqrt{3}}$

16. A common emitter amplifier circuit, built using an npn transistor, is shown in the figure. Its dc current gain is 250,

$R_C = 1 \text{ k}\Omega$ and $V_{CC} = 20 \text{ V}$. What is the minimum base current for V_{CE} to reach saturation ?
[DPYQ From 2019]

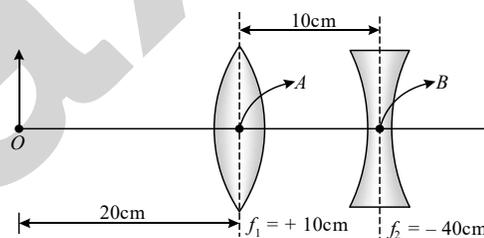


- (A) $100 \mu\text{A}$ (B) $7 \mu\text{A}$
(C) $40 \mu\text{A}$ (D) $80 \mu\text{A}$

17. A light wave is incident normally on a glass slab of refractive index 1.5. If 4% of light gets reflected and the amplitude of the electric field of the incident light is 50 V/m, then the amplitude of the electric field for the wave propagating in the glass medium will be :
[DPYQ From 2019]

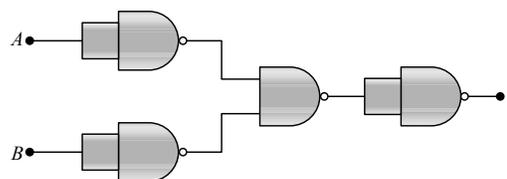
- (A) 10 V/m (B) 24 V/m
(C) 30 V/m (D) 40 V/m

18. What is the position and nature of image formed by lens combination shown in figure? (f_1, f_2 are focal lengths) :
[DPYQ From 2019]



- (A) 70 cm from point B at left, virtual
(B) 40 cm from point B at right, real
(C) $\frac{40}{3}$ cm from point B at right, real
(D) 70 cm from point B at right, real

19. The following logic gate is equivalent to :
[DPYQ From 2021]

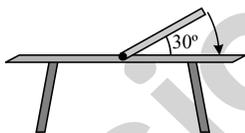


- (A) NOR Gate (B) OR Gate
(C) AND Gate (D) NAND Gate

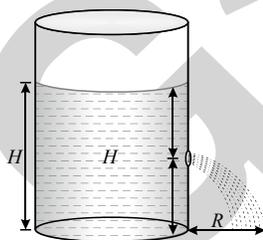
20. Taking the wavelength of first Balmer line in hydrogen spectrum ($n = 3$ to $n = 2$) as 600 nm, the wavelength of the 2nd Balmer line ($n = 4$ to $n = 2$) will be : [DPYQ From 2019]
 (A) 889.2 nm (B) 444.4 nm
 (C) 488.9 nm (D) 388.9 nm

Section-B: INTEGER Answer Type Questions

1. A person standing on a spring balance inside a stationary lift measures 50 kg. The weight of that person if the lift descends with uniform downward acceleration of 1.8 m/s^2 will be ____ N. [DPYQ From 2021]
2. A body of mass 2 kg is driven by an engine delivering a constant power 1 J/s. The body starts from rest and moves in a straight line. After 16 seconds, the body has moved a distance (in m) ____ . [DPYQ From 2020]
3. One end of a straight uniform 1 m long bar is pivoted on horizontal table. It is released from rest when it makes an angle 30° from the horizontal (see figure). Its angular speed when it hits the table is given as $\sqrt{n} \text{ s}^{-1}$, where n is an integer. The value of n is ____ . [DPYQ From 2020]



4. The water is filled upto height of 20 m in a tank having vertical sidewalls. A hole is made in one of the walls at a depth 'h' below the water level. The value of 'h' for which the emerging stream of water strikes the ground at the maximum range is ____ m. [DPYQ From 2021]



5. In a uniform magnetic field, the magnetic needle has a magnetic moment $9.85 \times 10^{-2} \text{ A/m}^2$ and moment of inertia $5 \times 10^{-6} \text{ kg m}^2$. If it performs 10 complete oscillations in 5 seconds then the magnitude of the magnetic field is ____ mT. [Take π^2 as 9.85]. [DPYQ From 2021]

6. 64 similar drops of mercury are maintained at 10 V each. All these spherical drops combine into a single big drop. The potential energy of the bigger drops is ____ times that of a smaller drop. [DPYQ From 2021]

7. A circular conducting coil of radius 1 m is being heated by the change of magnetic field \vec{B} passing perpendicular to the plane in which the coil is laid. The resistance of the coil is $4 \mu\Omega$. The magnetic field is slowly switched off such that its magnitude

changes in time as $B = \frac{4}{\pi} \times 10^{-3} \left(1 - \frac{t}{100}\right)$ tesla. The energy dissipated by the coil before the magnetic field is switched off completely is $E =$ ____ mJ : [DPYQ From 2021]

8. A deviation of 1° is produced in the yellow ray when prism of crown and flint glass are achromatically combined. Taking dispersive powers of crown and flint glass are 0.02 and 0.03 respectively and refractive index for yellow light for these glasses are 1.5 and 1.6 respectively. The refracting angles for crown glass prism will be ____ $^\circ$ (in degree) (Round off to the Nearest Integer) [DPYQ From 2021]

9. The surface of a metal is illuminated alternately with photons of energies $E_1 = 4 \text{ eV}$ and $E_2 = 2.5 \text{ eV}$ respectively. The ratio of maximum speeds of the photoelectrons emitted in the two cases is 4. The work function of the metal in (eV) is ____ . [DPYQ From 2020]

10. A transmitting station releases waves of wavelength 960 m. A capacitor of $2.56 \mu\text{F}$ is used in the resonant circuit. The self inductance of coil necessary for resonance is ____ $\times 10^{-8} \text{ H}$. [DPYQ From 2021]

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ANSWER KEY

Section - A: MCQs with Single Option Correct

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

Section-B: INTEGER Answer Type Questions

- | | | | |
|----------|------------|---------|---------|
| 1. (400) | 2. (42.66) | 3. (15) | 4. (10) |
| 5. (8) | 6. (1024) | 7. (40) | 8. (6) |
| 9. (2.4) | 10. (10) | | |

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