

APT Talent Search Exam 2023-24

* Indicates required question

1. Email *

2. Name of College, University *

3. Name of the student *

4. Register Number

5. 1. How much work is done in moving a charge of 2 C across two points having a potential difference of 12 V ?

Mark only one oval.

☐ 24 J

☐ 12 J

☐ 15 J

☐ 6 J

6. 2. A planet orbits the sun in an elliptical path as shown in the figure. Let v_p and v_a be speed of the planet when at perihelion and aphelion respectively. Which of the the following relations is correct.?

Mark only one oval.

$$\frac{r_p}{r_a} = \left(\frac{v_p}{v_a} \right)^{\frac{1}{2}}$$

☐

Option 1

$$\frac{r_p}{r_a} = \left(\frac{v_a}{v_p} \right)^{\frac{1}{2}}$$

☐

Option 2

$$\frac{r_p}{r_a} = \frac{v_a}{v_p}$$

☐

Option 3

$$\frac{r_p}{r_a} = \frac{v_p}{v_a}$$

☐

Option 4

7. 3. In case of a projectile if the maximum height H is equal to horizontal range R then angle of projection θ is

Mark only one oval.

$$\tan^{-1}(4)$$

☐

Option 1

$$\tan^{-1}\left(\frac{1}{4}\right)$$

☐

Option 2

$$\tan^{-1}\left(\frac{1}{2}\right)$$

☐

Option 3

$$\tan^{-1}(2)$$

☐

Option 4

8. 4. A stone is tied at one end of a 5 m long string and whirled in a vertical circle. The minimum speed at the topmost point is approximately (take $g=9.8 \text{ m/s}^2$)

Mark only one oval.

☐

1 m/s

☐

7 m/s

☐

3 m/s

☐

9 m/s

9. 5. By keeping moment of inertia of a body constant, if we double the time period, then angular momentum of body

Mark only one oval.

- ☐ doubles
- ☐ quadruples
- ☐ becomes half
- ☐ remains the same

10. 6. A bullet of 10 gm is fired from a pistol of 2 kg. If the recoil velocity of pistol is 2 m/s, find the muzzle velocity of bullet.

Mark only one oval.

- ☐ 400 m/s
- ☐ 20 m/s
- ☐ 200 m/s
- ☐ 40 m/s

11. 7. The moment of inertia of a regular circular disc of mass 0.8 kg and radius 100 cm about an axis perpendicular to the plane of the disc and passing through its centre is

Mark only one oval.

$$0.2 \text{ kg m}^2$$

☐

Option 1

$$0.4 \text{ kg m}^2$$

☐

Option 2

$$0.8 \text{ kg m}^2$$

☐

Option 3

$$1 \text{ kg m}^2$$

☐

Option 4

12. 8. A jester in a circus is standing with his arms extended at the centre of a turn table rotating with angular velocity ω . He brings his arms closer to his body so that his moment of inertia is reduced to one third of the original value. Find his new angular velocity. Neglect the mass of turn table

Mark only one oval.

$$\omega_f = 3\omega$$

☐

Option 1

$$\omega_f = \frac{1}{3}\omega$$

☐

Option 2

$$\omega_f = \frac{1}{9}\omega$$

☐

Option 3

$$\omega_f = 9\omega$$

☐

Option 4

13. 9. A solid rubber ball has its volume reduced by 14.5% when subjected to uniform stress of 14500 N/m^2 . Find the bulk modulus for rubber.

Mark only one oval.

$$10^5 \text{ N/m}^2$$

☐

Option 1

$$10^3 \text{ N/m}^2$$

☐

Option 2

$$10^4 \text{ N/m}^2$$

☐

Option 3

$$10^6 \text{ N/m}^2$$

☐

Option 4

14. 10. A cylinder of height 20m is completely filled with water. The velocity of efflux of water (in m/s) through a small hole on the side wall of the cylinder near its bottom is: ($g = 10 \text{ m/s}^2$)

Mark only one oval.

☐

10 m/s

☐

20 m/s

☐

30 m/s

☐

5 m/s

15. 11. Through a refinery, fuel ethanol is flowing in a pipe at a velocity of 1 m/s and a pressure of 101300 Pa. The refinery needs the ethanol to be at a pressure of 2 atm (202600 Pa) on a lower level. How far must the pipe drop in height in order to achieve this pressure? Assume the velocity does not change. The density of ethanol is 789 kg/ m³

Mark only one oval.

- ☐ 3 m
- ☐ 13 m
- ☐ 23 m
- ☐ 33 m

16. 12. A Carnot engine working between 27°C and 127°C takes up 800 J of heat from the reservoir in one cycle. What is the efficiency of the engine ?

Mark only one oval.

- ☐ 10 %
- ☐ 15 %
- ☐ 25 %
- ☐ 35 %

17. 13. According to the law of equipartition of energy, the energy associated with each degree of freedom is:

Mark only one oval.

- ☐ 1/2 kT
- ☐ kT
- ☐ 3/2 kT
- ☐ 2 kT

18. 14. We want to position a space probe along a line that extends directly toward the Sun in order to monitor solar flares. How far from Earth's center is the point on the line where the Sun's gravitational pull on the probe balances Earth's pull? Mass of sun and earth is

$$1.99 \times 10^{30} \text{ kg and } 5.98 \times 10^{24} \text{ kg}$$

Mark only one oval.

$$1.9 \times 10^{18} m$$

☐

Option 1

$$2.6 \times 10^8 m$$

☐

Option 2

$$3.9 \times 10^{14} m$$

☐

Option 3

$$9.8 \times 10^9 m$$

☐

Option 4

19. 15. The equation of a progressive wave is given by $y = 5 \sin(100\pi t - 0.4\pi x)$ where y and x are in m and t is in s. Which of the following statement is correct?

Mark only one oval.

☐

Amplitude is 100 m

☐

Angular frequency is 100π rad/s

☐

Frequency of the wave is 150 Hz.

☐

None of the above

20. 16. Which of the following forces is conservative?

Mark only one oval.

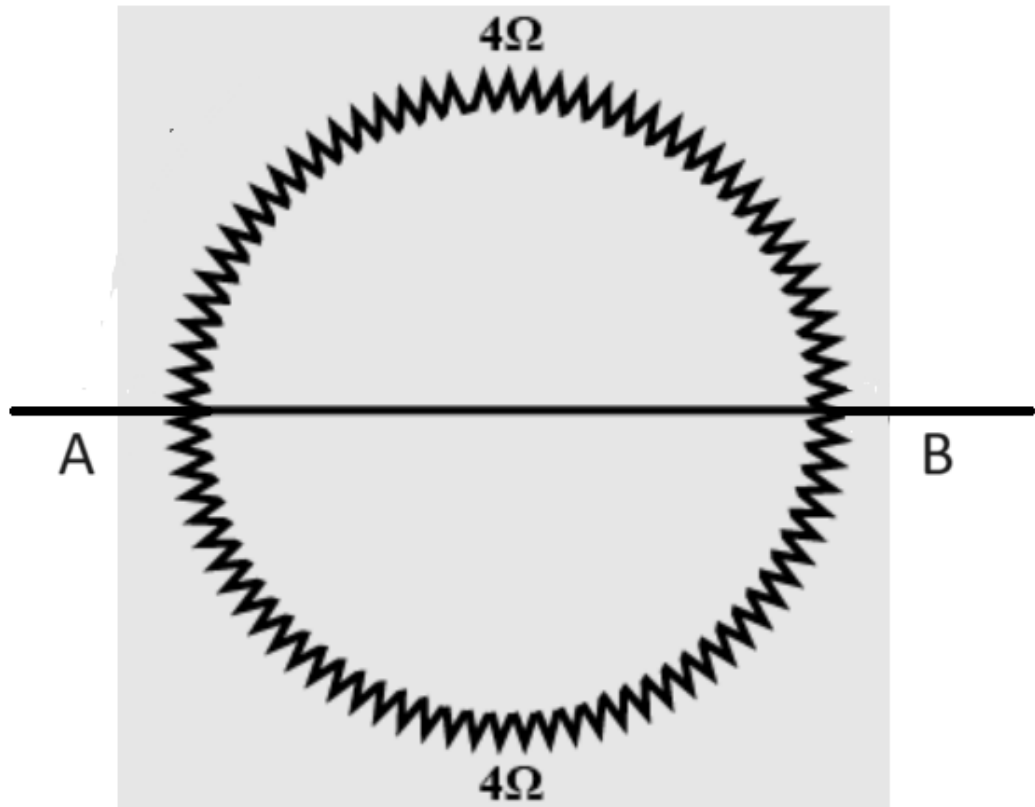
- ☐ Viscous force
- ☐ Gravitational force
- ☐ Frictional force
- ☐ All of the above

21. 17. As a car rolls along pavement, electrons move from the pavement first onto the tires and then onto the car body. The car stores this excess charge and the associated electric potential energy as if the car body were one plate of a capacitor and the pavement were the other plate. When the car stops, it discharges its excess charge and energy through the tires, just as a capacitor can discharge through a resistor. If a conducting object comes within a few centimeters of the car before the car is discharged, the remaining energy can be suddenly transferred to a spark between the car and the object. Suppose the conducting object is a fuel dispenser. The spark will not ignite the fuel and cause a fire if the spark energy is less than the critical value U (fire) 50 mJ. When the car stops at time $t = 0$, the car-ground potential difference is $V = 30$ kV. The car-ground capacitance (C) is 500 pF, and the resistance of each tire is $R = 100$ G Ω . How much time does the car take to discharge through the tires to drop below the critical value U (fire)?

Mark only one oval.

- ☐ 9.4 s
- ☐ 5.1 s
- ☐ 2.1 s
- ☐ 15.3 s

22. 18. A wire of resistance 8 ohm is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?



Mark only one oval.

- ☐ 1 ohm
- ☐ 2 ohm
- ☐ 4 ohm
- ☐ 8 ohm

23. 19. A circular coil of radius 5 cm and 50 turns carries a current of 3 A. The magnetic dipole moment of the coil is

Mark only one oval.

0.5 Ampere m^2

☐

Option 1

1.2 Ampere m^2

☐

Option 2

1.9 Ampere m^2

☐

Option 3

2.5 Ampere m^2

☐

Option 4

24. 20. A 400 mH coil of negligible resistance is connected to an AC circuit in which an effective current of 6 mA is flowing. Find out the inductive reactance of the coil if the frequency is 1000 Hz.

Mark only one oval.

☐ 2512 Ω

☐ 800 Ω

☐ 7887 Ω

☐ 628 Ω

25. 21. On heating, resistance of semiconductors

Mark only one oval.

- ☐ increases
- ☐ decreases
- ☐ no change
- ☐ may increase or decrease depending on semiconductor

26. 22. The significant result deduced from Rutherford's scattering experiment is that

Mark only one oval.

- ☐ there are neutrons inside the nucleus
- ☐ there are electrons inside the nucleus
- ☐ the whole of the positive charge is concentrated at the centre of an atom
- ☐ the whole of the positive charge is distributed uniformly in an atom

27. 23. Calculate the energy associated with a photon of wavelength 400 nm.

Mark only one oval.

- ☐ 1.09 eV
- ☐ 2.09 eV
- ☐ 3.09 eV
- ☐ 4.09 eV

28. 24. Calculate the threshold frequency of photon for photoelectric emission from a metal of work function 0.1 eV

Mark only one oval.

$$0.24 \times 10^{14} \text{ Hz}$$

☐

Option
n 1

$$0.24 \times 10^{10} \text{ Hz}$$

☐

Option
n 2

$$0.24 \times 10^{12} \text{ Hz}$$

☐

Option
n 3

$$0.24 \times 10^{16} \text{ Hz}$$

☐

Option
n 4

29. 25. An electron and an alpha particle have same de-Broglie wavelength. How are their kinetic energies related to each other? Given mass of an alpha particle is $6.64 \times 10^{-27} \text{ kg}$.

Mark only one oval.

$$K_e = 7294 K_\alpha$$

☐

Option 1

$$K_\alpha = 7294 K_e$$

☐

Option 2

$$K_\alpha = 801 K_e$$

☐

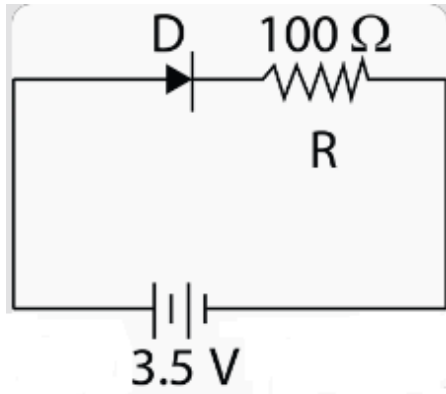
Option 3

$$K_e = 801 K_\alpha$$

☐

Option 4

30. 26. In the given figure, a diode D is connected to an external resistance $R=100\Omega$ and an e.m.f. of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be



Mark only one oval.

- ☐ 60 mA
- ☐ 50 mA
- ☐ 40 mA
- ☐ 30 mA

31. 27. A radio active substance has a life cycle of four months. Three fourth of the substance will decay in:

Mark only one oval.

- ☐ three months
- ☐ five months
- ☐ eight months
- ☐ sixteen months

32. 28. In Young's double slit experiment, the 10th maximum of wavelength λ_1 is at a distance y_1 from its central maximum and the 5th maximum of wavelength λ_2 is at a distance y_2 from its central maximum. The ratio y_1/y_2 will be :

Mark only one oval.

$$\frac{2\lambda_2}{\lambda_1}$$

☐

Option 1

$$\frac{\lambda_2}{2\lambda_1}$$

☐

Option 2

$$\frac{2\lambda_1}{\lambda_2}$$

☐

Option 3

$$\frac{\lambda_1}{2\lambda_2}$$

☐

Option 4

33. 29. A ray of light is incident on a glass slab making an angle of 60° with the surface. Calculate the angle of refraction in glass and velocity of light in glass if the refractive index of glass and velocity of light in air are 1.5 and 3.0×10^8 m/s respectively

Mark only one oval.

$28^\circ 30'$, 3×10^8 m/sec

☐

Option 1

$28^\circ 30'$, 2.5×10^8 m/sec

☐

Option 2

$40^\circ 20'$, 2.5×10^8 m/sec

☐

Option 3

$35^\circ 15'$, 2×10^8 m/sec

☐

Option 4

34. 30. A convex lens of focal length 10 cm is placed at a distance of 12 cm from a wall. How far from the lens should an object be placed so as to form its real image on the wall?

Mark only one oval.

☐ 15 cm

☐ 30 cm

☐ 60 cm

☐ 120 cm