

APT Talent Search Examination 2021-22

Student details are asked in the first section

* Indicates required question

1. Name of student *

2. APT TSE Register number assigned by your center coordinator (Example: SJCW *
ALPY 001)

3. Name of your College with address *

APT Talent Search Examination 2021-22

PART A: Answer all questions. There are 30 multiple choice questions with No negative marks. Each question carries 1 mark.

4. Answer the following question

A cyclist accelerates uniformly from rest and reaches a location at a speed of 9 m/s along a straight path. If the cyclist covers the last 10 m of his ride in 2 sec, the acceleration of cyclist is

(A) 5 m/s^2 (B) 3 m/s^2 (C) 8 m/s^2 (D) 4 m/s^2

Mark only one oval.

☐ A

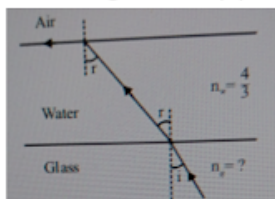
☐ B

☐ C

☐ D

5. Answer the following question

A ray of light is incident at the glass-water interface shown in the figure below at an angle i . It emerges finally parallel to the surface of water. Then the value of n_g would be



- (A) $(4/3) \sin i$ (B) $1/\sin i$ (C) $4/3$ (D) 1

Mark only one oval.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

6. Answer the following question

A 2 kg body falls from infinity to the surface of Earth. What will be the kinetic energy of the body on reaching the surface of Earth? (Assume escape velocity to be 10^4 m/s)

- (A) 10^8 J (B) 10^{16} J (C) 10^{20} J (D) 10^{24} J

Mark only one oval.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

7. Answer the following question

Two blocks of masses m_1 and m_2 are connected by a light spring on a smooth horizontal surface. The two masses are pulled apart and released, Then, the ratio of the magnitudes of acceleration of the masses will be

(A) $a_1/a_2 = m_1/m_2$ (B) $a_1/a_2 = m_2/m_1$ (C) $a_1/a_2 = 1$ (D) None of these

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

8. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is

Mark only one oval.

☐ (A) equal to that due to gravity.

☐ (B) less than that due to gravity.

☐ (C) more than that due to gravity.

☐ (D) depends on the diameter of the ring and the length of the magnet.

9. A stone thrown upwards with speed u attains maximum height h . Another stone thrown upwards from the same point with speed $2u$ attains maximum height H . What is the relation between h and H ?

Mark only one oval.

☐ (A) $2h = H$

☐ (B) $3h = H$

☐ (C) $4h = H$

☐ (D) $5h = H$

10. A beam of electrons passes undeflected through mutually perpendicular electric and magnetic fields. If the electric field is switched off, and the same magnetic field is maintained, the electrons move

Mark only one oval.

- ☐ (A) in a circular orbit.
- ☐ (B) along a parabolic path.
- ☐ (C) along a straight line.
- ☐ (D) in an elliptical orbit.

11. Answer the following question

A cubical block of wood of edge 0.2 m weighing 6.4 kgf floats on water. Find the depth of immersion. (The density of water is 1000 kg/m^3 .) (A) 0.16 m (B) 0.8 m (C) 1.57 m (D) 0.2 m

Mark only one oval.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

12. A rocket is fired from the earth to the moon. The distance between the earth and the moon is r and the mass of the earth is 81 times the mass of the moon. The gravitational force on the rocket will be zero, when its distance from the moon is

Mark only one oval.

- ☐ (A) $r/20$
- ☐ (B) $r/15$
- ☐ (C) $r/10$
- ☐ (D) $r/5$

13. Answer the following question

Two electrons are separated by 1 cm. The ratio of the gravitational force to the electrostatic force between the two electrons (A) 10^{43} (B) 10^{-43} (C) 10^{-36} (D) 10^{36}

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

14. Answer the following question

A reversible engine converts one sixth of heat input into work. When the temperature of the sink is reduced by 62°C , it's efficiency is doubled. Find the temperature of source and sink.

Mark only one oval.

☐ (A) 372 K & 310 K

☐ (B) 327 K & 301 K

☐ (C) 237 K & 130 K

☐ (D) None of the above

15. A proton and an electron are rotating in a plane in the presence of a uniform magnetic field of 1 tesla. What can you say about the sense of the rotation and their frequencies.

Mark only one oval.

☐ (A) Both rotate with the same sense and the electron rotates 1834 times faster

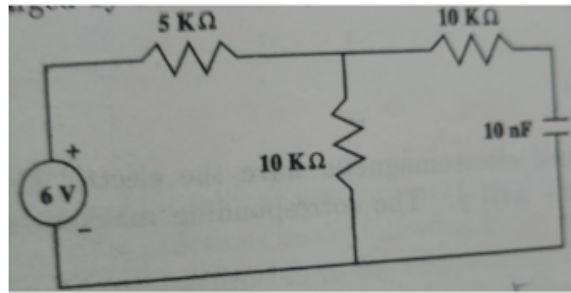
☐ (B) Both rotate with the same sense and the electron rotates 1834 times slower

☐ (C) They rotate in opposite directions and the electron rotates 1834 times faster

☐ (D) None of the above

16. Answer the following question

A capacitor is charged by a 6V battery through the following circuit. The final voltage across the capacitor is



(A) 1 V (B) 3 V (C) 4 V (D) 6 V

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

17. A certain material undergoes radioactive decay. If initially there is 50 mg of the material present and after 2 hours 10% of the material has decayed. What is the half life of the material?

Mark only one oval.

☐ (A) 13 hours

☐ (B) 10 hours

☐ (C) 5 hours

☐ (D) 6.5 hours

18. Answer the following question

Ampere's law states that (A) $\nabla \cdot \mathbf{B} = 0$ (B) $\nabla \cdot \mathbf{E} = 0$ (C) $\nabla \cdot \mathbf{E} = \mu_0 \mathbf{J}$ (D) $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 \int \mathbf{J} \cdot d\mathbf{a}$

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

19. A simple pendulum consists of a hollow metal bob of radius r attached to an inextensible string of length l . The pendulum has a period T for small oscillations. The bottom half of the bob is now filled with a uniform solid material of density ρ . The new time period for small oscillations is

Mark only one oval.

☐ (A) shorter than T

☐ (B) same as T

☐ (C) longer than T

☐ (D) shorter or longer than T depending on the values of ρ .

20. Which of the following scientist proposed new idea that "The gravity could be an emergent phenomenon"

Mark only one oval.

☐ (A) Stepehn Hawking

☐ (B) Albert Einstein

☐ (C) Thanu Padmanabhan

☐ (D) Kip Thorne

21. Answer the following question

Gaseous O_2 (molecular mass 32 amu) and N_2 (molecular mass 28 amu) are maintained at equilibrium at constant temperatures of 400 K and 200 K respectively. What is the ratio $V_{rms}(N_2)/V_{rms}(O_2)$ of the root-mean-square speeds of the molecules?

(A) $7/8$ (B) $\sqrt{7/8}$ (C) $\sqrt{8/7}$ (D) $\sqrt{4/7}$

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

22. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds for every lap. The average velocity and average speed for each circular lap respectively

Mark only one oval.

☐ (A) 0, 0

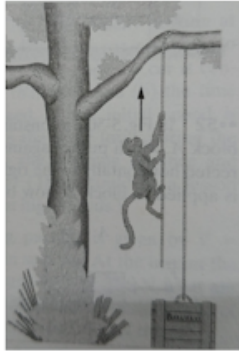
☐ (B) 0, 10 m/s

☐ (C) 10 m/s, 10 m/s

☐ (D) 10 m/s, 0

23. Answer the following question

A 10 kg monkey climbs up a massless rope that runs over a frictionless tree limb and holds a 15 kg mass at the other end. What is the magnitude of the least acceleration the monkey must have if it is to lift the mass off the ground?



(A) 9.8 m/s^2 (B) 4.9 m/s^2 (C) 15 m/s^2 (D) 10 m/s^2 (E) 25 m/s^2

Mark only one oval.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

24. Answer the following question

An iron anchor of density 7870 kg/m^3 appears 200 N lighter in water than in air. What is the volume of the anchor? (Density of water is 1000 kg/m^3) (A) $7.87 \times 10^2 \text{ m}^3$ (B) $0.787 \times 10^{-2} \text{ m}^3$ (C) $20.4 \times 10^{-2} \text{ m}^3$ (D) $2.04 \times 10^{-2} \text{ m}^3$

Mark only one oval.

- ☐ A
- ☐ B
- ☐ C
- ☐ D

25. Answer the following question

Two space-ships of length l_0 approaching the Earth from opposite directions at velocities $\pm c$, where c is the speed of light. Then the length of one spaceship as measured by the other is

(A) $3l_0/5$ (B) $2l_0/5$ (C) $l_0/5$ (D) $4l_0/5$

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

26. Calculate the principal focal length of an optical system consisting of two thin lenses, one convex of focal length +20 cm and the other concave of focal length -10 cm separated by 15 cm in air. Calculate the equivalent focal length of the lens system.

Mark only one oval.

☐ (A)+20 cm

☐ (B) -20 cm

☐ (C)-40 cm

☐ (D)+40 cm

27. An electric dipole placed in a non-uniform electric field experiences:

Mark only one oval.

☐ (A) a force but no torque

☐ (B) neither a force nor a torque

☐ (C) a torque and a force

☐ (D) a torque but no force

28. Answer the following question

A wave is represented by the equation $y = 7 \sin (7\pi t - 0.04x + \pi/3)$, where x is in meters and t is in seconds. The speed of the wave is:

- (A) 49π m/s (B) 175π m/s (C) $49/\pi$ m/s (D) 0.28π m/s

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

29. Answer the following question

A proton, a neutron, a β -particle and an α -particle are moving with equal speed. Which of the following is correct?

1. β -particle has the greatest de Broglie wavelength.

2. α -particle has the smallest de Broglie wavelength.

- (A) 1 only (B) 2 only (C) both 1 and 2 (D) neither 1 nor 2

Mark only one oval.

☐ A

☐ B

☐ C

☐ D

30. Considering the motion of a satellite around Earth, the physical quantity that is conserved is:

Mark only one oval.

- ☐ (A) velocity
- ☐ (B) linear momentum
- ☐ (C) angular momentum
- ☐ (D) all of the above

31. What happens to the internal energy of a gas during adiabatic expansion?

Mark only one oval.

- ☐ (A) Increases
- ☐ (B) Decreases
- ☐ (C) Remains Constant
- ☐ (D) None of the above

32. Eight rain drops of 1 mm each falling down with a terminal velocity of 5 cm/s coalesce to form a bigger drop. Find the terminal velocity of the bigger drop

Mark only one oval.

- ☐ (A) 20 cm/s
- ☐ (B) 20 m/s
- ☐ (C) 2 cm/s
- ☐ (D) 2 m/s

33. A cable is cut to half of it's original length. Is there any change in the amount of maximum load the cable can support?

Mark only one oval.

- ☐ (A) No
- ☐ (B) Yes. There is an increase in the maximum load the cable can support
- ☐ (C) Yes. There is a decrease in the maximum load the cable can support
- ☐ (D) None of the above

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