TALLENTEX Physics Sample Paper – 8

Duration: 23 Minutes | Maximum Marks: 60

Instructions

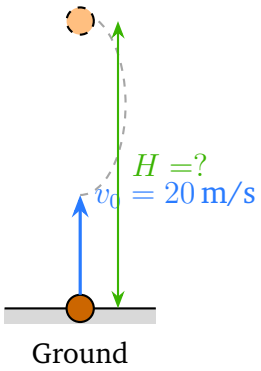
- This paper contains **15 MCQ** questions, each with a **single correct answer**.
- Marking scheme: **+4** marks for correct answer, **−1** mark for wrong answer, **0** for unattempted.
- Syllabus: **NCERT Class 8 and Class 9 Physics**.
- **No** mobile phones, calculators, or electronic gadgets are allowed.

Section – Physics (Q1 to Q15)

Q1. A car is moving at 108 km/h. Its speed in m/s is:

A. 3 m/s
B. 0.03 m/s
C. 10.8 m/s
D. 30 m/s

Q2. A ball is thrown vertically upward with an initial velocity of 20 m/s. Taking $g = 10\,\text{m/s}^2$, the maximum height reached by the ball is:



A. 20 m
B. 40 m
C. 10 m
D. 4 m

Q3. An acceleration-time (a-t) graph of a body shows a horizontal line at $a = 4\,\text{m/s}^2$ from $t = 0$ to $t = 5\,\text{s}$. The change in velocity of the body in this time interval is equal to:

A. 4 m/s
B. 20 m/s
C. 10 m/s
D. 80 m/s

Q4. When a vehicle moves along a curved (banked) road, the banking of the road provides:

A. Gravitational potential energy
B. Linear momentum
C. The centripetal force needed for circular motion
D. Friction between tyres and road

Q5. A system of two particles has its centre of mass at the midpoint between them. This is possible only when the two particles have:

A. Equal velocities
B. Equal kinetic energies
C. Equal charges
D. Equal masses

Q6. Water flows faster where a pipe narrows, and pressure is lower there. This observation is explained by:

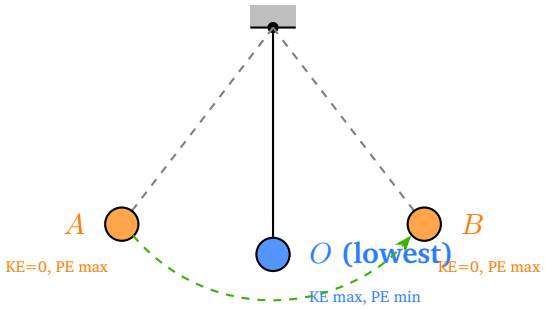
A. Bernoulli's principle
B. Pascal's law
C. Archimedes' principle
D. Newton's third law

Q7. A cube of side 10 cm is made of iron (density $= 7800\,\text{kg/m}^3$). Its mass is:

A. 0.78 kg

B. 7.8 kg
C. 78 kg
D. 780 kg

Q8. A simple pendulum swings from one extreme end A to the other end B through the lowest point O. At the lowest point O, which energy is maximum?



A. Potential energy
B. Both PE and KE are equal
C. Kinetic energy
D. Mechanical energy is zero

Q9. Which of the following is **NOT** a form of mechanical energy?

A. Kinetic energy
B. Gravitational potential energy
C. Elastic potential energy
D. Nuclear energy

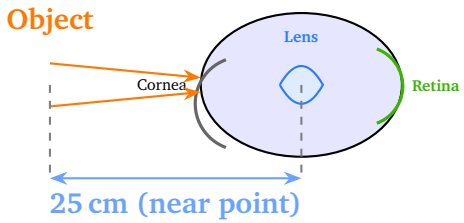
Q10. Two tuning forks of frequencies 256 Hz and 260 Hz are sounded together. The number of beats heard per second is:

A. 4 beats/s
B. 516 beats/s
C. 8 beats/s
D. 2 beats/s

Q11. A rainbow is formed due to a combination of which two phenomena?

A. Reflection and diffraction
B. Dispersion and total internal reflection
C. Refraction and polarisation
D. Interference and diffraction

Q12. The near point of a normal human eye is approximately:



A. 100 cm
B. 10 cm
C. 25 cm
D. 50 cm

Q13. When the temperature of a metallic conductor increases, its electrical resistance:

A. Decreases
B. Remains constant
C. First increases then decreases
D. Increases

Q14. A fuse wire in a domestic circuit melts and breaks the circuit when:

A. Current through it exceeds its safe limit
B. Voltage drops below safe value
C. Frequency of supply increases
D. Resistance in circuit increases

Q15. Which of the following is a correct property of magnetic field lines?

A. They form open curves

B. They never intersect each other

C. They always run parallel to each other

D. North pole is where they emerge and spread apart

Detailed Solutions

Q1.

Solution

Concept — Unit Conversion (Speed): To convert speed from km/h to m/s, multiply by $\frac{1000}{3600} = \frac{5}{18}$.

Step 1 — Apply the conversion factor:

$$108\,\text{km/h} \times \frac{5}{18} = \frac{108 \times 5}{18} = \frac{540}{18} = 30\,\text{m/s}$$

Why other options are wrong:

- Option A (3 m/s): Result of dividing 108 by 36 (incorrect factor).
- Option B (0.03 m/s): Incorrect decimal placement.
- Option C (10.8 m/s): Divides by 10 instead of multiplying by 5/18.

Final Answer: 30 m/s $\Rightarrow$ D

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept — Kinematics (Vertical Throw): When a body is thrown upward, it decelerates due to gravity. At maximum height, the final velocity becomes zero. Using the third equation of motion: $v^2 = u^2 - 2gH$.

Step 1 — Identify known values:

$$u = 20\,\text{m/s}, \quad v = 0\,\text{m/s (at top)}, \quad g = 10\,\text{m/s}^2$$

Step 2 — Apply $v^2 = u^2 - 2gH$:

$$0 = (20)^2 - 2 \times 10 \times H \implies 20H = 400 \implies H = 20\,\text{m}$$

Why other options are wrong:

- Option B (40 m): Forgetting the factor of 2 in $2gH$.
- Option C (10 m): Using $H = u/g$ (first equation, incorrect approach).
- Option D (4 m): Using $H = u^2/(g \times u)$, an invalid formula.

Final Answer: 20 m $\Rightarrow$ A

Answer: (A) Go Back to Q 2

Q3.

Solution

Concept — Acceleration-Time Graph: The area under an a-t graph gives the change in velocity of the body.

Step 1 — Identify the shape of the area: The a-t graph shows a horizontal line at $a = 4\,\text{m/s}^2$ from $t = 0$ to $t = 5\,\text{s}$. The area under this graph is a rectangle.

Step 2 — Calculate the area (= Δv):

$$\Delta v = a \times t = 4\,\text{m/s}^2 \times 5\,\text{s} = 20\,\text{m/s}$$

Why other options are wrong:

- Option A (4 m/s): Reads off only the value of acceleration, ignoring time.
- Option C (10 m/s): Average of 4 and 5 incorrectly applied.
- Option D (80 m/s): Multiplies $4 \times 5 \times 4$ (double counts).

Final Answer: 20 m/s $\Rightarrow$ B

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept — Banking of Roads (Circular Motion): When a road is banked (tilted at an angle), the normal reaction from the road has a horizontal component directed towards the centre of the circular path. This horizontal component provides the centripetal force required for circular motion.

Step 1 — Analyse forces on a banked road: The normal force N is perpendicular to the banked surface. Its horizontal component $N\sin\theta$ acts as the centripetal force, while its vertical component $N\cos\theta$ balances the weight mg of the vehicle.

Step 2 — Conclusion:

$$N\sin\theta = \frac{mv^2}{r} \quad \text{(centripetal force)}$$

Banking reduces dependence on friction for circular motion.

Why other options are wrong:

- Option A (Gravitational PE): Banking changes height but does not supply PE for circular motion.
- Option B (Linear momentum): Banking redirects forces; it does not supply linear momentum.
- Option D (Friction): Banking is designed specifically to reduce reliance on friction.

Final Answer: The centripetal force needed for circular motion $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Centre of Mass of Two Particles: The position of the centre of mass (CM) divides the line joining two particles in the inverse ratio of their masses.

Step 1 — Formula for CM position:

$$x_{\text{CM}} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$$

Step 2 — Condition for CM at midpoint: If CM is at the midpoint, $x_{\text{CM}} = \dfrac{x_1 + x_2}{2}$. Substituting:

$$\frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = \frac{x_1 + x_2}{2} \implies 2m_1 x_1 + 2m_2 x_2 = (m_1 + m_2)(x_1 + x_2) \implies (m_1 - m_2)(x_1 - x_2) = 0$$

Since $x_1 \neq x_2$ (they are at different positions), we need $m_1 = m_2$.

Why other options are wrong:

- Option A (Equal velocities): Velocity does not affect the static position of CM.
- Option B (Equal KE): KE depends on mass and velocity; does not determine CM position alone.
- Option C (Equal charges): Charge is irrelevant to the gravitational/inertial CM.

Final Answer: Equal masses $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 5

Q6.

Solution

Concept — Bernoulli's Principle (Fluid Dynamics): Bernoulli's principle states that for a steady, incompressible, non-viscous fluid flow, an increase in the speed of the fluid is accompanied by a decrease in pressure.

Step 1 — Apply continuity equation: For an incompressible fluid, the equation of continuity gives:

$$A_1 v_1 = A_2 v_2$$

When the pipe narrows ($A_2 < A_1$), velocity increases ($v_2 > v_1$).

Step 2 — Bernoulli's equation:

$$P + \tfrac{1}{2}\rho v^2 + \rho g h = \text{constant}$$

As v increases in the narrower section, P must decrease, which is exactly the observation described.

Why other options are wrong:

- Option B (Pascal's law): Pascal's law deals with pressure transmission in static fluids.
- Option C (Archimedes' principle): This relates to buoyant force on submerged objects.
- Option D (Newton's third law): This is about action-reaction pairs of forces.

Final Answer: Bernoulli's principle $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q 6

Q7.

Solution

Concept — Density and Mass: The relationship between mass, density, and volume is: Mass = Density $\times$ Volume.

Step 1 — Convert side length to metres and calculate volume:

$$\text{Side} = 10\,\text{cm} = 0.1\,\text{m}$$

$$\text{Volume} = (0.1)^3 = 0.001\,\text{m}^3 = 10^{-3}\,\text{m}^3$$

Step 2 — Calculate mass:

$$\text{Mass} = \rho \times V = 7800\,\text{kg/m}^3 \times 10^{-3}\,\text{m}^3 = 7.8\,\text{kg}$$

Why other options are wrong:

- Option A (0.78 kg): Uses volume in cm^3 without proper conversion (10^3 error).
- Option C (78 kg): Off by a factor of 10 in unit conversion.
- Option D (780 kg): Uses side length of 10 m instead of 0.1 m.

Final Answer: 7.8 kg $\Rightarrow$ B

Answer: (B) Go Back to Q 7

Q8.

Solution

Concept — Energy in a Pendulum (Conservation of Mechanical Energy): In a simple pendulum, mechanical energy is conserved. At the extreme positions (A and B), the bob is momentarily at rest: all energy is potential energy (PE) and kinetic energy (KE) is zero. At the lowest point (O), the bob has maximum speed: all PE has been converted to KE.

Step 1 — Energy at extremes A and B:

$$v = 0 \implies \text{KE} = 0, \quad \text{PE} = \text{maximum} = mgh$$

Step 2 — Energy at lowest point O:

$$h = 0 \text{ (reference)} \implies \text{PE} = 0 \text{ (minimum)}, \quad \text{KE} = \text{maximum}$$

Total mechanical energy: $E = \text{KE}_{\text{max}} = mgh$

Why other options are wrong:

- Option A (Potential energy): PE is zero at the lowest point, not maximum.
- Option B (Both PE and KE equal): This occurs at intermediate positions between A/B and O.
- Option D (Mechanical energy is zero): Mechanical energy is conserved and

not zero.

Final Answer: Kinetic energy $\Rightarrow$ C

Answer: (C) Go Back to Q 8

Q9.

Solution

Concept — Forms of Energy: Mechanical energy refers to the energy associated with the motion and position of macroscopic objects. It includes only **kinetic energy** (energy of motion) and **potential energy** (energy of position/configuration).

Step 1 — Classify each option:

- Kinetic energy: $\frac{1}{2}mv^2$ — *mechanical energy* (energy of motion).
- Gravitational PE: mgh — *mechanical energy* (energy due to position in gravity).
- Elastic PE: $\frac{1}{2}kx^2$ — *mechanical energy* (energy stored in a stretched/compressed spring).
- Nuclear energy: Energy stored in the nucleus due to nuclear binding forces — *NOT mechanical energy*.

Why other options are wrong:

- Options A, B, C: All are standard forms of mechanical energy (KE or PE).

Final Answer: Nuclear energy $\Rightarrow$ D

Answer: (D) Go Back to Q 9

Q10.

Solution

Concept — Beats (Sound): When two sound waves of slightly different frequencies are superimposed, they produce a periodic variation in loudness called **beats**. The beat frequency equals the absolute difference between the two frequencies.

Step 1 — Apply the beat frequency formula:

$$f_{\text{beat}} = |f_1 - f_2| = |260 - 256| = 4\,\text{Hz}$$

So 4 beats are heard per second.

Why other options are wrong:

- Option B (516 beats/s): This is the sum of the two frequencies, not the difference.
- Option C (8 beats/s): Double the correct answer; perhaps from 2×4, which has no physical basis.
- Option D (2 beats/s): Half of the correct answer; incorrect.

Final Answer: 4 beats/s $\Rightarrow$ A

Answer: (A) Go Back to Q 10

Q11.

Solution

Concept — Rainbow Formation (Optics): A rainbow is formed when sunlight enters spherical water droplets suspended in the atmosphere. Inside the droplet, sunlight undergoes:

(a) **Refraction and dispersion** at the air–water interface (separates white light into its constituent colours).
(b) **Total internal reflection** from the back wall of the droplet.
(c) A second refraction (and further dispersion) as light exits the droplet.

Step 1 — Key phenomena: The two primary phenomena are **dispersion** (separation of colours) and **total internal reflection** (light reflected internally inside the droplet).

Why other options are wrong:

- Option A (Reflection and diffraction): Diffraction plays no significant role in rainbow formation.
- Option C (Refraction and polarisation): Polarisation is not responsible for rainbow formation.
- Option D (Interference and diffraction): These are not the primary causes of rainbow colours.

Final Answer: Dispersion and total internal reflection $\Rightarrow$ B

Answer: (B) Go Back to Q 11

Q12.

Solution

Concept — Near Point of the Human Eye: The **near point** (or least distance of distinct vision) is the closest distance at which a normal human eye can see objects clearly without strain. For a normal adult eye, this distance is standardised at **25 cm** (also written as $D = 25\,\text{cm}$).

Step 1 — Standard value:

$$d_{\text{near}} = 25\,\text{cm}$$

This value is used in all optics calculations involving the human eye and is specified in NCERT Class 10 Science.

Why other options are wrong:

- Option A (100 cm): This is roughly the far point of a myopic eye, not the near point.
- Option B (10 cm): This is less than the standard near point; a young child may have near point $\approx$ 7–10 cm, but the standard value is 25 cm.
- Option D (50 cm): This is double the correct value; no standard basis.

Final Answer: 25 cm $\Rightarrow$ C

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept — Resistance and Temperature (Conductors): In metallic conductors, electrical resistance is caused by collisions between free electrons and the lattice ions. When temperature increases, the lattice ions vibrate with greater amplitude, causing more frequent and more vigorous collisions with the electrons. This **increases** the resistance.

Step 1 — Relationship (positive temperature coefficient):

$$R_T = R_0\,(1 + \alpha\,\Delta T)$$

where $\alpha > 0$ for metals. As ΔT increases, R_T increases.

Why other options are wrong:

- Option A (Decreases): This behaviour is seen in semiconductors and insulators, not metals.

- Option B (Remains constant): Only true for special alloys like Constantan (manganin); not typical metals.
- Option C (First increases then decreases): Characteristic of certain superconductors or thermistors, not ordinary metallic conductors.

Final Answer: Increases $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept — Electric Fuse (Safety Device): A fuse is a safety device made of a thin wire of low melting point (e.g., tin-lead alloy). It is connected in series in a circuit. When the current through the circuit exceeds the safe limit (due to short circuit or overloading), the fuse wire **melts** and breaks the circuit, protecting appliances.

Step 1 — Working principle: The heating effect of current is given by: $H = I^2Rt$. When I exceeds the rated current of the fuse, the heat generated melts the fuse wire.

Why other options are wrong:

- Option B (Voltage drops): A drop in voltage reduces current; the fuse would not melt.
- Option C (Frequency increases): Domestic AC supply frequency is fixed at 50 Hz; this is not a relevant factor.
- Option D (Resistance increases): Higher resistance in the circuit reduces current; fuse is safe.

Final Answer: Current exceeds safe limit $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q 14

Q15.

Solution

Concept — Properties of Magnetic Field Lines: Magnetic field lines are imaginary lines used to represent the direction and strength of a magnetic field. They have well-defined properties established from the theory of magnetism.

Step 1 — Key properties:

- Magnetic field lines are **closed loops** (they run from N-pole outside the magnet to S-pole and return through the magnet).
- They **never intersect** each other (if they did, there would be two directions of field at one point, which is impossible).
- They are closer (denser) where the field is stronger.
- They emerge from the **North pole** and enter the **South pole** outside the magnet.

Why other options are wrong:

- Option A (Form open curves): Magnetic field lines are always *closed* loops.
- Option C (Always run parallel): Field lines are parallel only in a uniform field region; generally they are not.
- Option D (North pole is where they emerge and spread apart): Partially true (they emerge from N), but "spread apart" is not a defining correct property; Option B is the universally correct fundamental property.

Final Answer: They never intersect each other $\Rightarrow$ B

Answer: (B) **Go Back to Q 15**

Questions 1–15									
1	D	2	A	3	B	4	C	5	D
6	A	7	B	8	C	9	D	10	A
11	B	12	C	13	D	14	A	15	B