TALLENTEX Physics

Sample Paper – 4

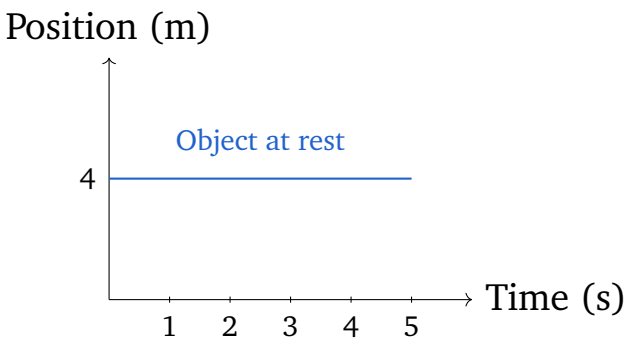
Duration: 23 Minutes **Maximum Marks: 60**

Instructions

- This paper contains **15** Multiple Choice Questions (Single Correct Answer), modelled on the Physics portion of **TALLENTEX** entrance.
- Each correct answer carries **+4 marks**. There is **a penalty of** -1 **mark** for incorrect answers. Unattempted questions carry no penalty.
- Only **one** option is correct. Choose carefully.
- Syllabus: **NCERT Class 8 and Class 9 Physics**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Section A — Multiple Choice Questions (MCQ)

Q1. The position-time graph of an object is shown in the figure. The graph shows a straight horizontal line. This represents:



(A) Uniform motion

(B) Non-uniform motion

(C) Uniform acceleration

(D) The object is at rest

Q2. A car moving at $20\,\text{m/s}$ decelerates uniformly at $4\,\text{m/s}^2$. The distance travelled by the car before it comes to rest is:

(A) 100 m

(B) 5 m

(C) 50 m

(D) 200 m

Q3. A ball is thrown vertically upward with an initial velocity of $30\,\text{m/s}$. Taking $g = 10\,\text{m/s}^2$, the time taken to reach the maximum height is:

(A) 5 s

(B) 3 s

(C) 1 s

(D) 6 s

Q4. A vehicle of mass 1000 kg moves at 72 km/h. Its momentum is:

(A) $20\,000\,\text{kg}\cdot\text{m/s}$

(B) $72\,000\,\text{kg}\cdot\text{m/s}$

(C) $1000\,\text{kg}\cdot\text{m/s}$

(D) $2000\,\text{kg}\cdot\text{m/s}$

Q5. A force of 500 N acts on a 50 kg object for 0.2 s. The impulse of the force is:

(A) $10\,000\,\text{Ns}$

(B) $2500\,\text{Ns}$

(C) $50\,\text{Ns}$

(D) $100\,\text{Ns}$

Q6. Two objects attract each other with a gravitational force F when separated by distance r. If the distance between them is doubled to $2r$, the

new gravitational force is:

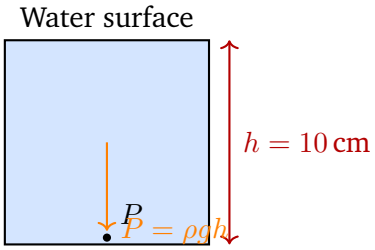
(A) $4F$

(B) $2F$

(C) $\frac{F}{4}$

(D) $\frac{F}{2}$

Q7. A water column of height 10 cm exerts pressure on the bottom of a container (density of water $= 1000\,\text{kg/m}^3$, $g = 10\,\text{m/s}^2$). The pressure at the bottom is:



(A) $10\,000\,\text{Pa}$

(B) $1000\,\text{Pa}$

(C) $100\,\text{Pa}$

(D) $10\,\text{Pa}$

Q8. A spring-loaded toy gun stores 50 J of elastic potential energy. When fired on a frictionless surface, the kinetic energy of the ball (assuming no energy loss) is:

(A) 50 J

(B) 100 J

(C) 25 J

(D) Zero

Q9. One horsepower (1 hp) is equal to:

(A) 1000 W

(B) 100 W

(C) 550 W

(D) 746 W

Q10. The speed of sound in air is 340 m/s and the minimum time interval for the human ear to distinguish an echo from the original sound is 0.1 s. The minimum distance from a reflecting wall to hear a distinct echo is:

(A) 34 m

(B) 340 m

(C) 17 m

(D) 8.5 m

Q11. A convex mirror is preferred over a plane mirror as a rear-view mirror in vehicles because a convex mirror:

(A) Magnifies objects

(B) Provides a wider field of view

(C) Forms real images

(D) Has a longer focal length than a concave mirror

Q12. An object is placed 20 cm in front of a concave mirror with a focal length of 10 cm. Using the mirror formula, the magnification produced is:

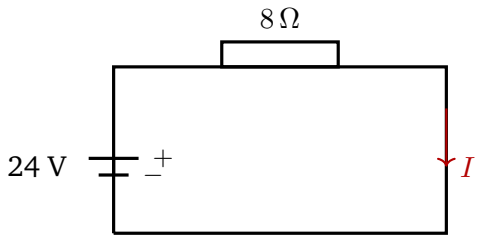
(A) -1 (real, inverted, same size)

(B) $+2$ (virtual, erect, magnified)

(C) -2 (real, inverted, magnified)

(D) $+1$ (virtual, erect, same size)

Q13. In the circuit shown, a resistor of $8\,\Omega$ is connected to a 24 V battery. The power dissipated in the resistor is:



(A) 3 W

(B) 192 W

(C) 8 W

(D) 72 W

Q14. The heating effect of electric current is used in:

(A) Electric motor

(B) Loudspeaker

(C) Electric iron

(D) Electric generator

Q15. The magnetic field inside a long current-carrying solenoid is:

(A) Zero everywhere inside

(B) Uniform and parallel to the axis

(C) Non-uniform and perpendicular to the axis

(D) Maximum at the ends and minimum at the centre

Detailed Solutions

Q1.

Solution

A horizontal position-time (s-t) graph means the position does not change with time — the object remains at the same location throughout. Hence the object is **at rest**.

Uniform motion (A) would give a straight diagonal line (non-zero slope); uniform acceleration (C) would give a parabolic curve; non-uniform motion (B) would give an irregular curve.

Answer: (D)

Q2.

Solution

Using the kinematic equation $v^2 = u^2 - 2as$ with $v = 0$, $u = 20\,\text{m/s}$, $a = 4\,\text{m/s}^2$:

$$0 = 20^2 - 2 \times 4 \times s \implies 8s = 400 \implies s = \mathbf{50}\,\text{m}.$$

Option A uses u^2/a (missing factor of 2); B gives $u/a = 5\,\text{m}$; D uses u^2/a with a wrong factor.

Answer: (C)

Q3.

Solution

At maximum height the final velocity $v = 0$. Using $v = u - gt$:

$$0 = 30 - 10 \times t \implies t = \frac{30}{10} = \mathbf{3}\,\text{s}.$$

Option A ($t = 5\,\text{s}$) uses $u/(2g)$; C ($t = 1\,\text{s}$) uses an incorrect value of u; D ($t = 6\,\text{s}$) is the total flight time $2u/g$, not the time to maximum height.

Answer: (B)

Q4.

Solution

First convert the speed: $72\,\text{km/h} = 72 \times \dfrac{1000}{3600} = 20\,\text{m/s}$.

Momentum $p = mv = 1000 \times 20 = \mathbf{20\,000}\,\text{kg} \cdot \text{m/s}$.

Option B uses the speed in km/h directly (1000×72); C ignores velocity; D uses $v = 2\,\text{m/s}$.

Answer: (A)

Q5.

Solution

Impulse $= F \times t = 500 \times 0.2 = \mathbf{100}$ Ns.

Option A multiplies $F \times m = 500 \times 50 = 25\,000$ (wrong); B multiplies by an extra factor; C computes F/t.

Answer: (D)

Q6.

Solution

By Newton's law of gravitation, $F \propto \dfrac{1}{r^2}$. When the distance is doubled ($r \to 2r$):

$$F_{\text{new}} = \frac{F}{(2)^2} = \frac{\mathbf{F}}{\mathbf{4}}.$$

Option A ($4F$) would require the distance to be halved; B and D imply a linear dependence on distance, which is incorrect.

Answer: (C)

Q7.

Solution

First convert height: $h = 10\,\text{cm} = 0.10\,\text{m}$.

$$P = \rho g h = 1000 \times 10 \times 0.10 = \mathbf{1000}\,\text{Pa}.$$

Option A omits the cm-to-m conversion and gets $1000 \times 10 \times 10 = 100\,000$ Pa; C forgets ρ; D divides by an extra factor of 100.

Answer: (B)

Q8.

Solution

By the law of conservation of energy, with no energy loss (frictionless surface), all the elastic potential energy converts to kinetic energy:

$$KE = PE_{\text{elastic}} = \mathbf{50}\,\text{J}.$$

Option B (100 J) violates conservation; C (25 J) loses half the energy without justification; D (Zero) implies no energy transfer at all.

Answer: (A)

Q9.

Solution

By definition, $1\,\text{hp} = \mathbf{746}\,\text{W}$ (British/mechanical horsepower).

Option A (1000 W) is 1 kilowatt; B (100 W) is far too small; C (550) corresponds to 550 ft·lbf/s, which is the imperial-unit definition of horsepower but is not equal to 550 W.

Answer: (D)

Q10.

Solution

The sound travels to the wall and returns, covering twice the wall distance in time $t = 0.1\,\text{s}$:

$$\text{Total path} = v \times t = 340 \times 0.1 = 34\,\text{m}.$$

Minimum distance to wall $= 34/2 = \mathbf{17}\,\text{m}$.

Option A (34 m) is the total round-trip distance, not the one-way distance; B (340 m) is just the speed; D (8.5 m) halves again incorrectly.

Answer: (C)

Q11.

Solution

A convex mirror always produces small, virtual, and erect images of objects over a wide range of distances. Because the image is diminished, the mirror covers a **wider field of view** than an equivalent plane mirror — making it ideal as a rear-view mirror.

It does not magnify objects (A); it never forms real images (C); the focal-length comparison in (D) does not explain the practical advantage.

Answer: (B)

Q12.

Solution

Using the sign convention: $u = -20\,\text{cm}$, $f = -10\,\text{cm}$ (concave mirror).

Mirror formula: $\dfrac{1}{v} = \dfrac{1}{f} - \dfrac{1}{u} = \dfrac{1}{-10} - \dfrac{1}{-20} = -\dfrac{1}{10} + \dfrac{1}{20} = \dfrac{-2+1}{20} = -\dfrac{1}{20}$.

So $v = -20\,\text{cm}$. Magnification: $m = -\dfrac{v}{u} = -\dfrac{-20}{-20} = \mathbf{-1}$.

The image is real, inverted, and of the same size as the object.

Answer: (A)

Q13.

Solution

Current in circuit: $I = \dfrac{V}{R} = \dfrac{24}{8} = 3\,\text{A}$.

Power dissipated: $P = I^2R = 3^2 \times 8 = 9 \times 8 = \mathbf{72}\,\text{W}$.

(Alternatively: $P = \dfrac{V^2}{R} = \dfrac{576}{8} = 72\,\text{W}$.)

Option A gives the current (3 A, not watts); B uses $P = V \times I = 24 \times 8 = 192\,\text{W}$ (using R in place of I); C gives just R.

Answer: (D)

Q14.

Solution

An electric iron works on Joule's law of heating: $H = I^2Rt$. It converts electrical energy directly into **heat**, which is used to press clothes.

An electric motor (A) converts electrical energy to mechanical energy; a loudspeaker (B) converts it to sound energy; an electric generator (D) produces electrical energy from mechanical energy (opposite effect).

Answer: (C)

Q15.

Solution

Inside a long current-carrying solenoid, the magnetic field lines are parallel to the axis and the field has a **uniform magnitude** throughout the interior. This makes the solenoid behave like a bar magnet, with a strong, uniform field inside.

Option A is wrong because the field is not zero inside; C is wrong because the field is parallel (not perpendicular) to the axis; D is wrong because the field is weaker at the ends, not stronger.

Answer: (B)

Answer Key

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