PHYSICS (03)

SYLLABUS : Errors in Measurement, Least Count, Accuracy & Precision and Significant figures.

Date : _____

1. The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimation of the kinetic energy obtained by measuring mass and speed
   - (a) 11%
   - (b) 8%
   - (c) 5%
   - (d) 1%

2. If the time period of oscillation of a pendulum is measured as 2.5 second using a stopwatch with the least count $\frac{1}{2}$ second, then the permissible error in the measurement is
   - (a) 10%
   - (b) 30%
   - (c) 15%
   - (d) 20%

3. The unit of percentage error is
   - (a) Same as that of physical quantity
   - (b) Different from that of physical quantity
   - (c) Percentage error is unit less
   - (d) Errors have got their own units which are different from that of physical quantity measured

4. A thin copper wire of length l metre increases in length by 2% when heated through 10°C. What is the percentage increase in area when a square copper sheet of length l metre is heated through 10°C
   - (a) 4%
   - (b) 8%
   - (c) 16%
   - (d) None

5. If radius of the sphere is $(5.3 \pm 0.1)cm$. Then percentage error in its volume will be
   - (a) $3 + 6.01 \times \frac{100}{5.3}$
   - (b) $\frac{1}{3} \times 0.01 \times \frac{100}{5.3}$
   - (c) $\left(\frac{3 \times 0.1}{5.3}\right) \times 100$
   - (d) $\frac{0.1}{5.3} \times 100$

6. The pressure on a square plate is measured by measuring the force on the plate and the length of the sides of the plate. If the maximum error in the measurement of force and length are respectively 4% and 2%, the maximum error in the measurement of pressure is
   - (a) 1%
   - (b) 2%
   - (c) 6%
   - (d) 8%

RESPONSE GRID

1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ
6. ⓐⓑⓒⓓ

7. The period of oscillation of a simple pendulum in the experiment is recorded as 2.63 s, 2.56 s, 2.42 s, 2.71s and 2.80s respectively. The average absolute error is

   (a) 0.1 s   (b) 0.11 s

   (c) 0.01 s   (d) 1.0 s

8. According to *Joule*'s law of heating, heat produced $H = I^2 Rt$, where I is current, R is resistance and t is time. If the errors in the measurement of I, R and t are 3%, 4% and 6% respectively then error in the measurement of H is

   (a) ± 17%   (b) ± 16%

   (c) ± 19%   (d) ± 25%

9. A physical quantity is given by $X = M^a L^b T^c$. The percentage error in measurement of M, L and T are α, β and γ respectively. Then maximum percentage error in the quantity X is

   (a) $a\alpha + b\beta + c\gamma$ (b) $a\alpha + b\beta - c\gamma$

   (c) $\dfrac{a}{\alpha} + \dfrac{b}{\beta} + \dfrac{c}{\gamma}$ (d) None of these

10. The mass and volume of a body are found to be 5.00 ± 0.05 kg and 1.00 ± 0.05 m^3 respectively. Then the maximum possible percentage error in its density is

   (a) 6%   (b) 3%

   (c) 10%   (d) 5%

11. A body travels uniformly a distance of (13.8 ± 0.2) m in a time (4.0 ± 0.3)s. The velocity of the body within error limits is

   (a) (3.45 ± 0.2) $m\text{-}s^{-1}$ (b) (3.45 ± 0.3) $m\text{-}s^{-1}$

   (c) (3.45 ± 0.4) $m\text{-}s^{-1}$ (d) (3.45 ± 0.5) $m\text{-}s^{-1}$

12. In an experiment, the following observation's were recorded : $L = 2.820\,m$, $M = 3.00\,kg$, $l = 0.087$ cm, diameter $D = 0.041\,cm$. Taking $g = 9.81$ m/s^2 using the formula , $Y = \dfrac{4MgL}{\pi D^2 l}$, the maximum permissible error in Y is

   (a) 7.96%   (b) 4.56%

   (c) 6.50%   (d) 8.42%

RESPONSE GRID	7. ⓐⓑⓒⓓ 8. ⓐⓑⓒⓓ 9. ⓐⓑⓒⓓ 10. ⓐⓑⓒⓓ 11. ⓐⓑⓒⓓ
	12. ⓐⓑⓒⓓ

13. The values of two resistors are $R_1 = (6 \pm 0.3)\, k\Omega$ and $R_2 = (10 \pm 0.2)\, k\Omega$. The percentage error in the equivalent resistance when they are connected in parallel is
   (a) 5.125%
   (b) 2%
   (c) 10.125%
   (d) 7%

14. The number of significant figures in all the given numbers 25.12, 2009, 4.156 and 1.217×10^{-4} is
   (a) 1
   (b) 2
   (c) 3
   (d) 4

15. The length, breadth and thickness of a block are given by $l = 12$ cm, $b = 6$ cm and $t = 2.45$ cm. The volume of the block according to the idea of significant figures should be
   (a) $1 \times 10^2\, cm^3$
   (b) $2 \times 10^2\, cm^3$
   (c) $1.763 \times 10^2\, cm^3$
   (d) None of these

16. You measure two quantities as $A = 1.0\, m \pm 0.2$ m, $B = 2.0\, m \pm 0.2$ m. We should report correct value for $\sqrt{AB}$ as
   (a) $1.4\, m \pm 0.4\, m$
   (b) $1.41\, m \pm 0.15\, m$
   (c) $1.4\, m \pm 0.3\, m$
   (d) $1.4\, m \pm 0.2\, m$

17. Which of the following measurement is most precise?
   (a) 5.00 mm
   (b) 5.00 cm
   (c) 5.00 m
   (d) 5.00 km

18. The mean length of an object is 5 cm. which of the following measurements is most accurate?
   (a) 4.9 cm
   (b) 4.805 cm
   (c) 5.25 cm
   (d) 5.4 cm

19. The Vernier scale of a travelling microscope has 50 divisions which coincide with 49 main scale divisions. If each main scale division is 0.5 mm, then what is the minimum inaccuracy in the measurement of distance?
   (a) 0.02 mm
   (b) 0.05 mm
   (c) 0.01 mm
   (d) 0.1 mm

20. Time for 20 oscillations of a pendulum is measured as $t_1 = 39.6$ s, $t_2 = 39.9$ s and $t_3 = 39.5$ s. What is the accuracy of the measurement?
   (a) ± 0.1 s
   (b) ± 0.2 s
   (c) ± 0.01 s
   (d) ± 0.5 s

RESPONSE GRID					
13. (a)(b)(c)(d)	14. (a)(b)(c)(d)	15. (a)(b)(c)(d)	16. (a)(b)(c)(d)	17. (a)(b)(c)(d)
18. (a)(b)(c)(d)	19. (a)(b)(c)(d)	20. (a)(b)(c)(d)		

21. A physical quantity P is given by $P = \dfrac{A^3 B^{\frac{1}{2}}}{C^{-4} D^{\frac{3}{2}}}$. The quantity which brings in the maximum percentage error in P is

   (a) A (b) B

   (c) C (d) D

22. The focal length f of a mirror is given by $\dfrac{1}{f} = \dfrac{1}{u} + \dfrac{1}{v}$ where u and v represent object and image distances respectively. Then

   (a) $\dfrac{\Delta f}{f} = \dfrac{\Delta u}{u} + \dfrac{\Delta v}{v}$

   (b) $\dfrac{\Delta f}{f} = \dfrac{\Delta u}{v} + \dfrac{\Delta v}{u}$

   (c) $\dfrac{\Delta f}{f} = \dfrac{\Delta u}{u} + \dfrac{\Delta v}{v} - \dfrac{\Delta(u+v)}{u+v}$

   (d) $\dfrac{\Delta f}{f} = \dfrac{\Delta u}{u} + \dfrac{\Delta v}{v} + \dfrac{\Delta u}{u+v} + \dfrac{\Delta v}{u+v}$

23. For a cubical block, error in measurement of sides is $\pm 1\%$ and error in measurement of mass is $\pm 2\%$, then maximum possible error in density is

   (a) 1%   (b) 5%

   (c) 3%   (d) 7%

24. To estimate 'g' $\left(\text{from } g = 4\pi^2 \dfrac{L}{T^2} \right)$, error in measurement of L is $\pm\ 2\%$ and error in measurement of T is $\pm\ 3\%$. The error in estimated 'g' will be -

   (a) $\pm 8\%$ (b) $\pm 6\%$

   (c) $\pm 3\%$ (d) $\pm 5\%$

25. An experiment measures quantities x, y, z and then t is calculated from the data as $t = \dfrac{xy^2}{z^3}$. If percentage errors in x, y and z are respectively 1%, 3%, 2%, then percentage error in t is:

   (a) 10%   (b) 4%

   (c) 7%   (d) 13%

NUMERICAL VALUE TYPE QUESTIONS

Questions from 26 to 30 are numerical value type according to the new pattern for JEE Main by NTA.

26. A physical quantity z, depends upon two other physical quantities x and y, as follows $z = ax^2 y^{1/2}$ where, a is a constant. In an experiment, the quantity x is determined by measuring z and y, and using the above expression. If the percentage error in the measurement of z and y are 10% and 12% respectively, then the percentage error in the determined value of x is

27. Acceleration due to gravity on the surface of the earth is $g = \dfrac{GM}{R^2}$. The gravitational constant G is exactly known. But percentage error in measurement of the mass of earth M and radius of the earth R are 1% and 2%, respectively. The maximum percentage error in measurement of acceleration due to gravity on the surface of the earth is $n\%$. Find the value of n.

28. During measurement of kinetic energy T, the percentage error in measurement of mass of the particle and momentum of particle are 2% and 3%, respectively. The percentage error in measurement of kinetic energy is $n\%$. Find the value of n.

29. If $y = 2.21 \times 0.3$, then find the value of significant digits in the value of y.

30. If $x = 0.72 + 0.8 + 3.87 - 1.089$, then find the value of significant digits in the value of x.

RESPONSE GRID	21. (a)(b)(c)(d)	22. (a)(b)(c)(d)	23. (a)(b)(c)(d)	24. (a)(b)(c)(d)	25. (a)(b)(c)(d)
	26. ○○	27. ○○	28. ○○	29. ○○	30. ○○

PHYSICS (04)

SYLLABUS : Speed, Velocity, Acceleration, Uniform & Non-Uniform Motion, Position-Time,

Acceleration-Time graphs and Kinematics Equations

Date : _____

1. The displacement-time graph for two particles A and B are straight lines inclined at angles of $30°$ and $60°$ with the time axis. The ratio of velocities of $V_A : V_B$ is
   (a) $1:2$
   (b) $1:\sqrt{3}$
   (c) $\sqrt{3}:1$
   (d) $1:3$

2. The ratio of the numerical values of the average velocity and average speed of a body is always
   (a) Unity
   (b) Unity or less
   (c) Unity or more
   (d) Less than unity

3. A particle moves along a straight-line path, after some time it comes to rest. The motion is with constant acceleration whose direction with respect to the direction of velocity is:
   (a) positive throughout motion
   (b) negative throughout motion
   (c) first positive then negative
   (d) first negative then positive

4. A particle moves with a uniform velocity. Which of the following statements about the motion of particle is correct?
   (a) Its acceleration is zero
   (b) Its speed is zero
   (c) Its speed may be variable
   (d) Its acceleration is opposite to the velocity

5. If a car covers $2/5^{th}$ of the total distance with v_1 speed and $3/5^{th}$ distance with v_2 then average speed is
   (a) $\frac{1}{2}\sqrt{v_1 v_2}$
   (b) $\frac{v_1 + v_2}{2}$
   (c) $\frac{2v_1 v_2}{v_1 + v_2}$
   (d) $\frac{5v_1 v_2}{3v_1 + 2v_2}$

6. A car moves a distance of $200m$. It covers first half of the distance at speed $60\,kmh^{-1}$ and the second half at speed v. If the average speed is $40\,kmh^{-1}$, the value of v is
   (a) $30\,kmh^{-1}$
   (b) $13\,kmh^{-1}$
   (c) $60\,kmh^{-1}$
   (d) $40\,kmh^{-1}$

RESPONSE GRID	1. (a)(b)(c)(d)	2. (a)(b)(c)(d)	3. (a)(b)(c)(d)	4. (a)(b)(c)(d)	5. (a)(b)(c)(d)
	6. (a)(b)(c)(d)				

7. A particle moving along a straight line covers half of the distance with a speed of 3 ms^{-1}. The other half of the distance is covered in two equal time intervals with speed of $4.5\,ms^{-1}$ and $7.5\,ms^{-1}$. The average speed of the particle (in ms^{-1}) is

(a) 5.0   (b) 5.5

(c) 5.8   (d) 4.0

8. A body travelling with uniform acceleration crosses two points A and B with velocities $20\,ms^{-1}$ and $30\,ms^{-1}$ respectively. The speed of the body at the mid-point of A and B is nearest to

(a) $25.5\ ms^{-1}$ (b) $25\,ms^{-1}$

(c) $24\ ms^{-1}$ (d) $10\sqrt{6}\,ms^{-1}$

9. Which graph represents a state of rest for an object

(a)   (b)

(c)   (d)
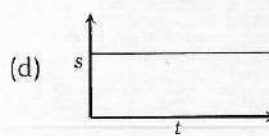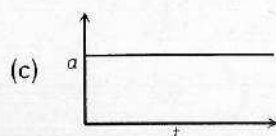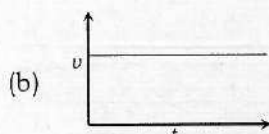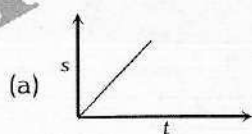
10. A bullet emerges from a barrel of length 1.2 m with a speed of $640\ ms^{-1}$. Assuming constant acceleration, the approximate time that it spends in the barrel after the gun is fired is

(a) 4 m-s   (b) 40 m-s

(c) 400 μs (d) 1 s

11. A car starts from rest and accelerates uniformly to a speed of 180 km-h^{-1} in 10 seconds. The distance covered by the car in this time interval is

(a) 500 m (b) 250 m

(c) 100 m (d) 200 m

12. A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 seconds on it, it moves with a velocity 2 m/sec in the opposite direction. The acceleration produced in it is

(a) $3\,m/sec^2$ (b) $-3\ m/sec^2$

(c) $0.3\,m/sec^2$ (d) $-0.3\,m/sec^2$

**13.** A body moves from rest with a constant acceleration of $5\,m/s^2$. Its instantaneous speed (in m/s) at the end of 10 sec is

(a) 50   (b) 5

(c) 2   (d) 0.5

RESPONSE GRID

7. ⓐⓑⓒⓓ   8. ⓐⓑⓒⓓ   9. ⓐⓑⓒⓓ   10. ⓐⓑⓒⓓ   11. ⓐⓑⓒⓓ

12. ⓐⓑⓒⓓ   13. ⓐⓑⓒⓓ

14. Two cars A and B at rest at same point initially. If A starts with uniform velocity of 40 m/sec and B starts in the same direction with constant acceleration of $4\,m/s^2$, then B will catch A after how much time

   (a) 10 sec (b) 20 sec
   (c) 30 sec (d) 35 sec

15. A body is moving with uniform acceleration describes 40 m in the first 5 sec and 65 m in next 5 sec. Its initial velocity will be

   (a) 4 m/s (b) 2.5 m/s
   (c) 5.5 m/s (d) 11 m/s

16. An object accelerates from rest to a velocity 27.5 m/s in 10 sec then find distance covered by object in next 10 sec

   (a) 550 m (b) 137.5 m
   (c) 412.5 m (d) 275 m

17. The initial velocity of a body moving along a straight line is $7\,m/s$. It has a uniform acceleration of $4\,m/s^2$. The distance covered by the body in the 5th second of its motion is

   (a) 25 m (b) 35 m
   (c) 50 m (d) 85 m

18. A body starts from rest with uniform acceleration. If its velocity after n second is v, then its displacement in the last two seconds is

   (a) $\dfrac{2v(n+1)}{n}$ (b) $\dfrac{v(n+1)}{n}$
   (c) $\dfrac{v(n-1)}{n}$ (d) $\dfrac{2v(n-1)}{n}$

19. A particle moves along a straight line, Its position at any instant is given by $x = 32t - \dfrac{8t^3}{4}$, where x is in metre and t is in second, Find the acceleration of the particle at the instant when particle is at rest.

   (a) -16 m/s^2 (b) -32 m/s^2
   (c) 32 m/s^2 (d) 16 m/s^2

20. A body starts from rest, with uniform acceleration a, The acceleration of the body as function of time t is given by the equation $a = pt$, where p is a constant, then the displacement of the particle in the time interval $t = 0$ to $t = t_1$ will be

   (a) $\dfrac{1}{2}pt_1^3$ (b) $\dfrac{1}{3}pt_1^2$
   (c) $\dfrac{1}{2}pt_1^2$ (d) $\dfrac{1}{6}pt_1^3$

21. A body moves in a plane so that the displacements along the x and y axes are given by $x = 3t^3$ and $y = 4t^3$. The velocity of the body is

   (a) $9t$ (b) $15t$
   (c) $15t^2$ (d) $25t^2$

22. Velocity-time (v-t) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is
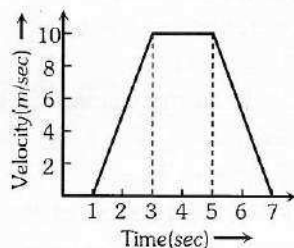
   (a) 60 m
   (b) 50 m
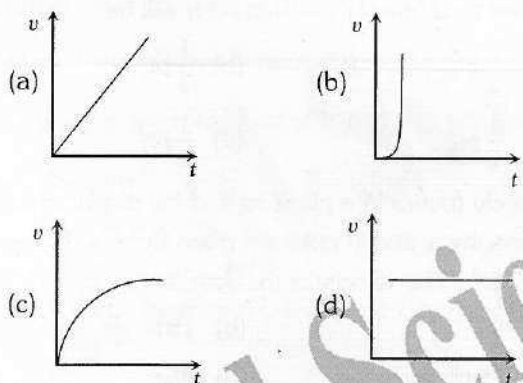   (c) 30 m
   (d) 40 m
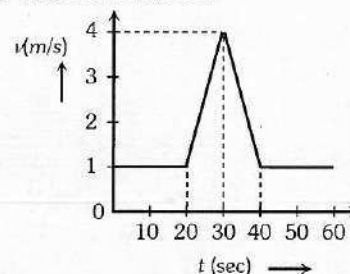
RESPONSE GRID	14. ⓐⓑⓒⓓ 15. ⓐⓑⓒⓓ 16. ⓐⓑⓒⓓ 17. ⓐⓑⓒⓓ 18. ⓐⓑⓒⓓ
	19. ⓐⓑⓒⓓ 20. ⓐⓑⓒⓓ 21. ⓐⓑⓒⓓ 22. ⓐⓑⓒⓓ

23. For the velocity-time graph shown in figure below the distance covered by the body in last two seconds of its motion is what fraction of the total distance covered by it in all the seven seconds
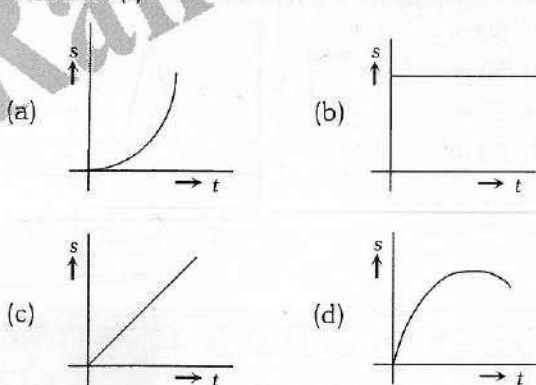
(a) 1/2
(b) 1/4
(c) 1/3
(d) 2/3

24. An object is dropped from rest. Its v-t graph is

25. A body is travelling in a straight line with a uniformly increasing speed. Which one of the plot represents the changes in distance (s) travelled with time (t)

NUMERICAL VALUE TYPE QUESTIONS

Questions from 26 to 30 are numerical value type according to the new pattern for JEE Main by NTA.

26. A fun drive in an amusement park runs between two spots that are 2.0 km apart. For safety reasons the acceleration of the drive is limited to $\pm 4.0\ m/s^2$, and the jerk, or rate of change of acceleration, is limited to $\pm 1.0\ m/s^2$. The drive has a maximum speed of 144 km/h. If the shortest time taken (in sec) by the drive to travel between the spots is m^2, find the value of m.

27. The position vector of a particle is given as $\vec{r} = (t^2 - 4t + 6)\hat{i} + (t^2)\hat{j}$. Find the time (in sec) after which the velocity vector and acceleration vector becomes perpendicular to each other.

28. The position of a particle moving rectilinearly is given by $x = t^3 - 3t^2 - 10$. If the distance (in m) travelled by the particle in the first 4 seconds starting from $t=0$ is $6k$. Find the value of k.

29. A balloon is moving along with constant upward acceleration of 1 m/s^2. A stone is thrown from the balloon downwards with speed 10 m/s with respect to the balloon. At the time of projection balloon is at height 120 m from the ground and is moving with speed 20 m/s. Find the time taken (in sec) by the stone to fall on the ground after the projection.

30. A train stopping at two stations 2 km apart on a straight line takes 4 minutes for the journey. Motion of the train is first uniformly accelerated and then uniformly retarded. If $\dfrac{1}{x} + \dfrac{1}{y} = f$, where x and y are the magnitude of the acceleration and retardation respectively. Find the value of f.

RESPONSE GRID	23. ⓐⓑⓒⓓ 24. ⓐⓑⓒⓓ 25. ⓐⓑⓒⓓ 26. ◯◯ 27. ◯◯
	28. ◯◯ 29. ◯◯ 30. ◯◯