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Angular momentum · JEE Main 2024 · Shift-I View Solution on Crucible ↗

1. A particle of mass m projected with a velocity u making an angle of 30° with the horizontal. The magnitude of angular momentum of the projectile about the point of projection when the particle is at its maximum height h is:

(A) $\frac{\sqrt{3}}{16}\frac{mu^3}{g}$
(B) $\frac{\sqrt{3}}{2}\frac{mu^2}{g}$
(C) $\frac{mu^3}{\sqrt{2}\,g}$
(D) zero

Momentum and kinetic energy · JEE Main 2024 · Shift-I View Solution on Crucible ↗

2. Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is :

(A) B
(B) A
(C) D
(D) C

Variation of g with Depth below Surface · JEE Main 2024 · Shift-II View Solution on Crucible ↗

3. Assuming the earth to be a sphere of uniform mass density, a body weighed $300\,\mathrm{N}$ on the surface of earth. How much it would weigh at $R/4$ depth under surface of earth?

(A) $75\,\mathrm{N}$
(B) $300\,\mathrm{N}$
(C) $375\,\mathrm{N}$
(D) $225\,\mathrm{N}$

Effect of temperature on elasticity · JEE Main 2024 · Shift-I View Solution on Crucible ↗

4. With rise in temperature, the Young's modulus of elasticity

(A) changes erratically
(B) decreases
(C) increases
(D) remains unchanged

Surface energy · JEE Main 2025 · Shift-I View Solution on Crucible ↗

5. The amount of work done to break a big water drop of radius $'R'$ into 27 small drops of equal radius is $10\,\mathrm{J}$. The work done required to break the same big drop into 64 small drops of equal radius will be

(A) $15\,\mathrm{J}$
(B) $5\,\mathrm{J}$
(C) $20\,\mathrm{J}$
(D) $10\,\mathrm{J}$

Moment of Inertia of Ring · JEE Main 2025 · Shift-II View Solution on Crucible ↗

6. The moment of inertia of a circular ring of mass M and diameter r about a tangential axis lying in the plane of the ring is :

(A) $\frac{1}{2}Mr^2$
(B) $\frac{3}{8}Mr^2$
(C) $\frac{3}{2}Mr^2$
(D) $2Mr^2$

Momentum and kinetic energy · JEE Main 2024 · Shift-I View Solution on Crucible ↗

7. Three bodies A, B and C have equal kinetic energies and their masses are $400\,\text{g}$, $1.2\,\text{kg}$ and $1.6\,\text{kg}$ respectively. The ratio of their linear momenta is :

(A) $\sqrt{2} : \sqrt{3} : 1$
(B) $1 : \sqrt{3} : 2$
(C) $1 : \sqrt{3} : \sqrt{2}$
(D) $\sqrt{3} : \sqrt{2} : 1$

Variation of g with Height above Surface · JEE Main 2022 · Shift-I View Solution on Crucible ↗

8. The approximate height from the surface of earth at which the weight of the body becomes $\frac{1}{3}$ of its weight on the surface of earth is : [Radius of earth $R = 6400\,\text{km}$ and $\sqrt{3} = 1.732$]

(A) $3840\,\text{km}$
(B) $4685\,\text{km}$
(C) $2133\,\text{km}$
(D) $4267\,\text{km}$

Hooke's law · JEE Main 2022 · Shift-I View Solution on Crucible ↗

9. A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses $1\,\text{kg}$ and $2\,\text{kg}$ are suspended respectively from its free end. Then the value of L is equal to

(A) $\sqrt{L_1 L_2}$
(B) $\frac{L_1+L_2}{2}$
(C) $2L_1 - L_2$
(D) $3L_1 - L_2$

Pascal's Law · JEE Main 2023 · Shift-II View Solution on Crucible ↗

10. A hydraulic automobile lift is designed to lift vehicles of mass $5000\,\text{kg}$. The area of cross section of the cylinder carrying load is $250\,\text{cm}^2$. The maximum pressure the smaller piston would have to bear is [Assume $g = 10\,\text{m s}^{-2}$]

(A) $20 \times 10^6\,\text{Pa}$
(B) $2 \times 10^5\,\text{Pa}$
(C) $200 \times 10^6\,\text{Pa}$
(D) $2 \times 10^6\,\text{Pa}$

Torque · JEE Main 2025 · Shift-II View Solution on Crucible ↗

11. The torque due to the force $(2\hat{i}+\hat{j}+2\hat{k})$ about the origin, acting on a particle whose position vector is $(\hat{i}+\hat{j}+\hat{k})$, would be

(A) $\hat{i}-\hat{k}$ **(B)** $\hat{i}+\hat{k}$

(C) $\hat{j}+\hat{k}$ **(D)** $\hat{i}-\hat{j}+\hat{k}$

Momentum and kinetic energy · JEE Main 2024 · Shift-II View Solution on Crucible ↗

12. When kinetic energy of a body becomes 36 times of its original value, the percentage increase in the momentum of the body will be :

(A) 6% **(B)** 600%

(C) 60% **(D)** 500%

Variation of g with Height above Surface · JEE Main 2023 · Shift-I View Solution on Crucible ↗

13. The weight of a body at the surface of earth is $18\,\mathrm{N}$. The weight of the body at an altitude of $3200\,\mathrm{km}$ above the earth's surface is (given, radius of earth $R_e = 6400\,\mathrm{km}$)

(A) $9.8\,\mathrm{N}$ **(B)** $4.9\,\mathrm{N}$

(C) $19.6\,\mathrm{N}$ **(D)** $8\,\mathrm{N}$

Hooke's law · JEE Main 2025 · Shift-I View Solution on Crucible ↗

14. Two wires A and B are made of same material having ratio of lengths $\frac{L_A}{L_B}=\frac{1}{3}$ and their diameters ratio $\frac{d_A}{d_B}=2$. If both the wires are stretched using same force, what would be the ratio of their respective elongations?

(A) $1:6$ **(B)** $1:12$

(C) $3:4$ **(D)** $1:3$

Excess Pressure inside Liquid Drop and Bubble · JEE Main 2024 · Shift-II View Solution on Crucible ↗

15. Pressure inside a soap bubble is greater than the pressure outside by an amount: (given: R = Radius of bubble, S = Surface tension of bubble)

(A) $\frac{2S}{R}$ **(B)** $\frac{4R}{S}$

(C) $\frac{S}{R}$ **(D)** $\frac{4S}{R}$

Law of conservation of angular momentum · JEE Main 2021 · Shift-I View Solution on Crucible ↗

16. The maximum and minimum distances of a comet from the Sun are $1.6 \times 10^{12}\,\text{m}$ and $8.0 \times 10^{10}\,\text{m}$ respectively. If the speed of the comet at the nearest point is $6 \times 10^{4}\,\text{m s}^{-1}$, the speed at the farthest point is

(A) $1.5 \times 10^{3}\,\text{m s}^{-1}$ **(B)** $6.6 \times 10^{3}\,\text{m s}^{-1}$

(C) $3.0 \times 10^{3}\,\text{m s}^{-1}$ **(D)** $4.5 \times 10^{3}\,\text{m s}^{-1}$

Conservation of linear momentum · JEE Main 2023 · Shift-II View Solution on Crucible ↗

17. A machine gun of mass $10\,\text{kg}$ fires $20\,\text{g}$ bullets at the rate of 180 bullets per minute with a speed of $100\,\text{m s}^{-1}$ each. The recoil velocity of the gun is :

(A) $0.02\,\text{m s}^{-1}$ **(B)** $2.5\,\text{m s}^{-1}$

(C) $1.5\,\text{m s}^{-1}$ **(D)** $0.6\,\text{m s}^{-1}$

Time period of revolution · JEE Main 2023 · Shift-II View Solution on Crucible ↗

18. The time period of a satellite of earth is 24 hours. If the separation between the earth and the satellite is decreased to one fourth of the previous value, then its new time period will become.

(A) $4\,\text{hours}$ **(B)** $6\,\text{hours}$

(C) $12\,\text{hours}$ **(D)** $3\,\text{hours}$

Hooke's law · JEE Main 2024 · Shift-I View Solution on Crucible ↗

19. Young's modules of material of a wire of length L and cross-sectional area A is Y. If the length of the wire is doubled and cross-sectional area is halved then Young's modules will be:

(A) $\frac{Y}{4}$ **(B)** $4Y$

(C) Y **(D)** $2Y$

Surface energy · JEE Main 2024 · Shift-II View Solution on Crucible ↗

20. A big drop is formed by coalescing 1000 small droplets of water. The surface energy will become:

(A) 100 times **(B)** 10 times

(C) $\frac{1}{100}$th **(D)** $\frac{1}{10}$th

Moment of Inertia of Rectangular Plate · JEE Main 2021 · Shift-I View Solution on Crucible ↗

21. Moment of inertia of a square plate of side l about the axis passing through one of the corner and perpendicular to the plane of square plate is given by :

(A) $\frac{Ml^2}{6}$ **(B)** $\frac{2}{3}Ml^2$

(C) Ml^2 **(D)** $\frac{Ml^2}{12}$

Momentum and kinetic energy · JEE Main 2022 · Shift-II View Solution on Crucible ↗

22. A body of mass $8\,\text{kg}$ and another of mass $2\,\text{kg}$ are moving with equal kinetic energy. The ratio of their respective momenta will be

(A) $1:1$ **(B)** $2:1$

(C) $1:4$ **(D)** $4:1$

Time period of revolution · JEE Main 2024 · Shift-II View Solution on Crucible ↗

23. A satellite revolving around a planet in stationary orbit has time period 6 hours. The mass of planet is one-fourth the mass of earth. The radius orbit of planet is : (Given = Radius of geo-stationary orbit for earth is $4.2 \times 10^4\,\text{km}$)

(A) $1.4 \times 10^4\,\text{km}$ **(B)** $1.05 \times 10^4\,\text{km}$

(C) $8.4 \times 10^4\,\text{km}$ **(D)** $1.68 \times 10^5\,\text{km}$

Poisson Ratio · JEE Main 2023 · Shift-I View Solution on Crucible ↗

24. Choose the correct relationship between Poisson ratio (σ), bulk modulus (K) and modulus of rigidity (η) of a given solid object:

(A) $\sigma = \frac{3K-2\eta}{6K+2\eta}$ **(B)** $\sigma = \frac{6K+2\eta}{3K-2\eta}$

(C) $\sigma = \frac{3K+2\eta}{6K+2\eta}$ **(D)** $\sigma = \frac{6K-2\eta}{3K-2\eta}$

Surface energy · JEE Main 2023 · Shift-I View Solution on Crucible ↗

25. A mercury drop of radius $10^{-3}\,\text{m}$ is broken into 125 equal size droplets. Surface tension of mercury is $0.45\,\text{N m}^{-1}$. The gain in surface energy is:

(A) $2.26 \times 10^{-5}\,\text{J}$ **(B)** $28 \times 10^{-5}\,\text{J}$

(C) $17.5 \times 10^{-5}\,\text{J}$ **(D)** $5 \times 10^{-5}\,\text{J}$

Moment of Inertia of Ring · JEE Main 2025 · Shift-II View Solution on Crucible ↗

26. A rod of linear mass density 'λ' and length 'L' is bent to form a ring of radius 'R'. Moment of inertia of ring about any of its diameter is :

(A) $\frac{\lambda L^3}{16\pi^2}$ **(B)** $\frac{\lambda L^3}{12}$

(C) $\frac{\lambda L^3}{4\pi^2}$ **(D)** $\frac{\lambda L^3}{8\pi^2}$

Impulse momentum principle · JEE Main 2023 · Shift-I View Solution on Crucible ↗

27. An average force of $125\,\mathrm{N}$ is applied on a machine gun firing bullets each of mass $10\,\mathrm{g}$ at the speed of $250\,\mathrm{m\,s^{-1}}$ to keep it in position. The number of bullets fired per second by the machine gun is :

(A) 50 **(B)** 25

(C) 100 **(D)** 5

Orbital velocity · JEE Main 2024 · Shift-II View Solution on Crucible ↗

28. Two satellite A and B go round a planet in circular orbits having radii $4R$ and R respectively. If the speed of A is $3v$, the speed of B will be :

(A) $3v$ **(B)** $6v$

(C) $\frac{4}{3}v$ **(D)** $12v$

Bulk Modulus · JEE Main 2021 · Shift-I View Solution on Crucible ↗

29. The normal density of a material is ρ and its bulk modulus of elasticity is K. The magnitude of increase in density of material, when a pressure P is applied uniformly on all sides, will be:

(A) $\frac{PK}{\rho}$ **(B)** $\frac{\rho P}{K}$

(C) $\frac{\rho K}{P}$ **(D)** $\frac{K}{\rho P}$

Surface energy · JEE Main 2024 · Shift-II View Solution on Crucible ↗

30. A small liquid drop of radius R is divided into 27 identical liquid drops. If the surface tension is T, then the work done in the process will be:

(A) $8\pi R^2 T$ **(B)** $3\pi R^2 T$

(C) $\frac{1}{8}\pi R^2 T$ **(D)** $4\pi R^2 T$

Answer Key (Q1 to Q30)

Click any question number below to open its exact step-by-step solution on The Crucible ↗

1: (A)	2: (B)	3: (D)	4: (B)	5: (A)	6: (B)	7: (B)	8: (B)	9: (C)	10: (D)
11: (A)	12: (D)	13: (D)	14: (B)	15: (D)	16: (C)	17: (D)	18: (D)	19: (C)	20: (D)
21: (B)	22: (B)	23: (B)	24: (A)	25: (A)	26: (D)	27: (A)	28: (B)	29: (B)	30: (A)

Sample Solution — Question 2 (Correct Option: B)

Open Full Solution on Crucible ↗

Q2. Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have same momentum, respectively. The particle with maximum kinetic energy is :

Ten seconds. When momentum is the same, use the link between kinetic energy and momentum.

$K = \frac{p^2}{2m}$

With p fixed, $K \propto \frac{1}{m}$. So the **lightest** particle has the most kinetic energy.

The masses are $\frac{m}{2}, m, 2m, 4m$. The lightest is A with $\frac{m}{2}$.

• **Watch out:** do not think "heavier body, more energy". That is true only when the speeds are equal. Here the momenta are equal, so the light body must move much faster.

Answer: (b) A

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