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PHYSICS · JEE MAIN

Gravitation

Previous Year Questions with answers

215 questions · **174** papers · **2002–2026** · newest paper first

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What is in this PDF: every Gravitation question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

Step-by-step solutions for every question are free in the EdLoop JEE app (Google Play) and on app.edloop.in. More chapters: pyq.edloop.in/free-pdfs/

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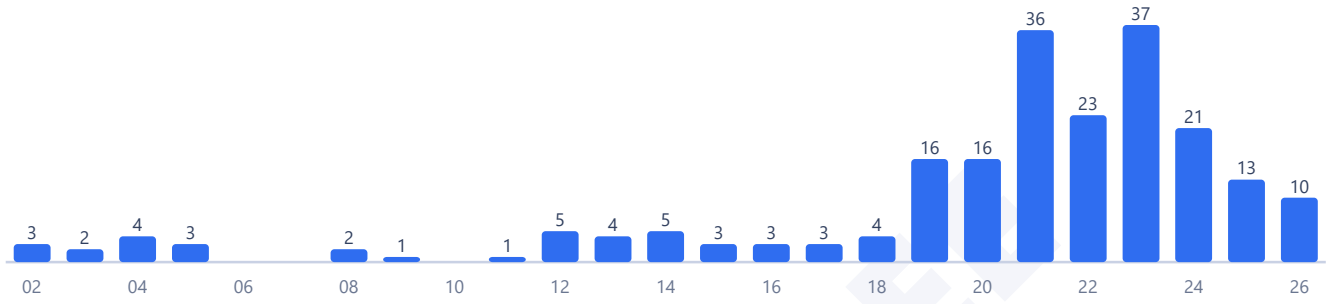
Chapter at a glance

3.8%	215	142 of 162	199 / 16
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Falling: 0.8 questions per paper in 2024–2026 against 1.2 in 2019–2023.

Questions per year



Counts are the questions we hold: 215 in 174 papers. No question in this chapter was found repeated across papers.

Most-asked topics in this chapter (2002–2026)



How often it comes up

Gravitation is one of the most dependable chapters in JEE Main Physics, providing clean, mathematically tractable questions on almost every exam day. Across the papers we hold from 2019 to 2026, it accounted for **172 questions in 162 papers**, which corresponds to **1.1 questions per paper**, and appeared in 142 of those 162 papers. That makes it the **10th largest of 29 Physics chapters** over that eight-year period, representing 3.8% of all Physics questions.

The chapter's share has stayed about the same over two decades of testing. Between 2002 and 2018, it took 3.2% of Physics; across the last three exam years (2024 to 2026), it stood at 2.8%, producing 44 questions across 58 papers. The busiest year in our set was 2021, when our records show 38 questions across 26 papers. Since 2019 there has been no year without it, appearing in 142 of the 162 papers we hold.

The chapter corresponds to Unit 6: Gravitation in NTA's Class 11 Physics syllabus. Its conceptual structure closely mirrors Electrostatics, meaning mastery of gravitational potential and field superposition directly reinforces Coulomb's law later in Class 12.

Most-asked topics

From 2019 to 2026, gravitation problems distributed across four main topics:

- **Newton's Law of Gravitation**: 62 questions. Variation of g with altitude, depth, and planetary rotation, along with force between distributed masses.
- **Satellites**: 61 questions. Orbital velocity, total mechanical energy, escape speed, and orbital altitude transitions.
- **Kepler's Laws**: 25 questions. Orbital period scaling, areal velocity conservation, and elliptical trajectory geometry.

- **Field & Potential**: 24 questions. Gravitational potential inside solid and hollow spheres, binding energy of discrete mass configurations, and field superposition.

All four topic divisions appeared in the 2026 question papers, so none can be safely set aside.

What the questions look like

Variation of acceleration due to gravity is the most frequent calculation. A typical problem asks for the height above Earth's surface where g falls to a stated fraction, such as g/9. Students must be careful not to use the linear approximation (1 - 2h/R) when h is comparable to Earth's radius, opting instead for the exact inverse-square relation $R^2 / (R + h)^2$. Other variations explore depth variations inside the Earth, where g decreases linearly toward zero at the center.

Satellite mechanics questions focus on energy bookkeeping. You will often calculate the energy input required to shift an orbiting satellite from an initial orbital radius to a higher circular orbit. Because total orbital energy equals negative kinetic energy, moving outward reduces kinetic energy while increasing gravitational potential energy, resulting in a net positive energy requirement. Escape velocity problems frequently ask you to scale escape speed to hypothetical planets with given ratios of density and radius.

Field and potential problems evaluate vector additions and scalar potential energies. A standard format places four masses at the vertices of a square, asking for the net gravitational pull at the center, or evaluates how the force shifts when two masses swap positions. Kepler's third law questions test period ratios when orbit radii or central star masses vary.

The numerical answer format appears moderately here: 16 of the 172 questions since 2019 had no options, requiring exact arithmetic.

How to practise it

Start by deriving the formulas for acceleration due to gravity at height h and depth d directly from Newton's law of gravitation and shell theorems. Commit to memory that g at depth d equals g(1 - d/R) for a uniform sphere, whereas at height h it follows $g R^2 / (R + h)^2$. Never mix up the two regimes.

Next, master satellite energy relationships. Remember that for a circular orbit of radius r around mass M, potential energy is -GMm/r, kinetic energy is GMm/(2r), and total energy is -GMm/(2r). This simple 2 : -1 : 1 relationship between potential, kinetic, and total energies will allow you to answer energy shift questions in under a minute without algebraic confusion.

For escape velocity, relate the formula to both mass and density. Writing escape velocity as proportional to R times the square root of density makes comparative problems straightforward when given density ratios. Finish by solving multi-particle potential energy problems, counting pairwise combinations systematically using n(n - 1)/2 for n masses.

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Q1 JEE Main 2026 · 5 Apr · Shift 1 MCQ

When one moves from a point 16 km below the earth's surface to a point 16 km above the earth's surface. The change in g is approximately α %. The value of α is _____.

(Take radius of the earth = 6400 km.)

(A) 0.12
(B) 0.25
(C) 0.50
(D) 0.75

Answer: (B) 0.25 · Official NTA final key

Q2 JEE Main 2026 · 5 Apr · Shift 2 MCQ

A body of mass m is taken from the surface of earth to a height equal to twice the radius of earth (R_e). The increase in potential energy will be _____.
(g is acceleration due to gravity at the surface of earth)

(A) $\frac{1}{2}mgR_e$
(B) $\frac{3}{4}mgR_e$
(C) $\frac{1}{4}mgR_e$
(D) $\frac{2}{3}mgR_e$

Answer: (D) $\frac{2}{3}mgR_e$ · Official NTA final key

Q3 JEE Main 2026 · 4 Apr · Shift 2 MCQ

The height in terms of radius of the earth (R), at which the acceleration due to gravity becomes $\frac{g}{9}$, where g is acceleration due to gravity on earth's surface, is _____.

(A) $\sqrt{3}R$
(B) $2\sqrt{2}R$
(C) $2R$
(D) $\frac{4}{9}R$

Answer: (C) $2R$ · Official NTA final key

Q4 JEE Main 2026 · 2 Apr · Shift 1 MCQ

A planet (P_1) is moving around the star of mass $2M$ in the orbit of radius R. Another planet (P_2) is moving around another star of mass $4M$ in a orbit of radius $2R$. Ratio of time periods of revolution of P_2 and P_1 is _____.

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(A) $\frac{1}{2}$
(B) 2
(C) 4
(D) $\frac{1}{4}$

Answer: (B) 2 · Official NTA final key

Q5 JEE Main 2026 · 2 Apr · Shift 2 MCQ

If a body of mass 1 kg falls on the earth from infinity, it attains velocity (v) and kinetic energy (k) on reaching the surface of earth. The values of v and k respectively are _____.
(Take radius of earth to be 6400 km and $g = 9.8$ m/s^2)

(A) 11.2 km/s; 6.27×10^7 J
(B) 11.2 km/s; 12.54×10^7 J
(C) 8.8 km/s; 6.27×10^7 J
(D) 8.8 km/s; 12.54×10^7 J

Answer: (A) 11.2 km/s; 6.27×10^7 J · Official NTA final key

Q6 JEE Main 2026 · 24 Jan · Shift 1 MCQ

Three masses 200 kg, 300 kg and 400 kg are placed at the vertices of an equilateral triangle with sides 20 m. They are rearranged on the vertices of a bigger triangle of side 25 m and with the same centre. The work done in this process _____ J.

(Gravitational constant G $= 6.7 \times 10^{-11}$ N m^2/ kg^2)

(A) 9.86×10^{-6}
(B) 2.85×10^{-7}
(C) 4.77×10^{-7}
(D) 1.74×10^{-7}

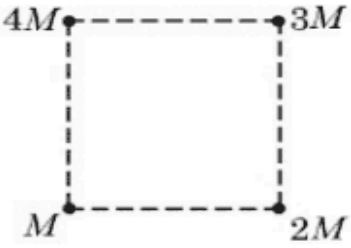
Answer: (D) 1.74×10^{-7} · Official NTA final key

Q7 JEE Main 2026 · 22 Jan · Shift 1 MCQ

Net gravitational force at the center of a square is found to be F_1 when four particles having mass M, $2M$, $3M$ and $4M$ are placed at the four corners of the square as shown in figure and it is F_2 when the positions of $3M$ and $4M$ are interchanged. The ratio $\frac{F_1}{F_2}$ is $\frac{\alpha}{\sqrt{5}}$. The value of α is _____.

(see the figure above)

Q.33 Net gravitational force at the center of a square is found to be F_1 when four particles having mass M, $2M$, $3M$ and $4M$ are placed at the four corners of the square as shown in figure and it is F_2 when the positions of $3M$ and $4M$ are interchanged. The ratio $\frac{F_1}{F_2}$ is $\frac{\alpha}{\sqrt{5}}$. The value of α is _____.



Options
1. 1
2. 3
3. $2\sqrt{5}$
4. 2

(A) 1
(B) 3
(C) $2\sqrt{5}$
(D) 2

Answer: (D) 2 · Official NTA final key

Q8 JEE Main 2026 · 22 Jan · Shift 1 MCQ

The escape velocity from a spherical planet A is 10 km/s. The escape velocity from another planet B whose density and radius are 10% of those of planet A, is _____ m/s.

(A) $1000\sqrt{2}$
(B) 1000
(C) $200\sqrt{5}$
(D) $100\sqrt{10}$

Answer: (D) $100\sqrt{10}$ · Official NTA final key

Q9 JEE Main 2026 · 22 Jan · Shift 2 MCQ

Given below are two statements :

Statement I : A satellite is moving around earth in the orbit very close to the earth surface. The time period of revolution of satellite depends upon the density of earth.

Statement II : The time period of revolution of the satellite is $T = 2\pi\sqrt{\frac{R_e}{g}}$ (for satellite very close to the earth surface), where R_e radius of earth and g acceleration due to gravity.

In the light of the above statements, choose the **correct** answer from the options given below :

(A) **Statement I** is true but **Statement II** is false
(B) Both **Statement I** and **Statement II** are true
(C) **Statement I** is false but **Statement II** is true
(D) Both **Statement I** and **Statement II** are false

Answer: (B) Both Statement I and Statement II are true · Official NTA final key

Q10 JEE Main 2026 · 21 Jan · Shift 1 MCQ

Initially a satellite of 100 kg is in a circular orbit of radius $1.5R_E$. This satellite can be moved to a circular orbit of radius $3R_E$ by supplying $\alpha \times 10^6$ J of energy. The value of α is _____. (Take Radius of Earth $R_E = 6 \times 10^6$ m and $g = 10$ m/s^2)

(A) 1000
(B) 150
(C) 100
(D) 500

Answer: (A) 1000 · Official NTA final key

Q11 JEE Main 2025 · 7 Apr · Shift 2 MCQ

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The radius vector from the Sun to a planet sweeps out equal areas in equal intervals of time and thus areal velocity of planet is constant.

Reason (R): For a central force field the angular momentum is a constant.

In the light of the above statements, choose the most appropriate answer from the options given below :

(A) (A) is not correct but (R) is correct
(B) (A) is correct but (R) is not correct
(C) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(D) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

Answer: (C) Both (A) and (R) are correct and (R) is the correct explanation of (A) · Key from source paper

Q12 JEE Main 2025 · 4 Apr · Shift 1 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A: The kinetic energy needed to project a body of mass m from earth surface to infinity is $\frac{1}{2}mgR$, where R is the radius of earth.

Reason R: The maximum potential energy of a body is zero when it is projected to infinity from earth surface.

In the light of the above statements, choose the correct answer from the options given below

(A) **A** is false but **R** is true

(B) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**

(C) **A** is true but **R** is false

(D) Both **A** and **R** are true and **R** is the correct explanation of **A**

Answer: (A) A is false but R is true · Key from source paper

Q13 JEE Main 2025 · 4 Apr · Shift 2 MCQ

An object is kept at rest at a distance of 3R above the earth's surface where R is earth's radius. The minimum speed with which it must be projected so that it does not return to earth is: (Assume M = mass of earth, G= Universal gravitational constant)

(A) $\sqrt{\frac{GM}{R}}$

(B) $\sqrt{\frac{3GM}{R}}$

(C) $\sqrt{\frac{GM}{2R}}$

(D) $\sqrt{\frac{2GM}{R}}$

Answer: (C) $\sqrt{\frac{GM}{2R}}$ · Key from source paper

Q14 JEE Main 2025 · 3 Apr · Shift 1 Numerical

Three identical spheres of mass m, are placed at the vertices of an equilateral triangle of length a. When released, they interact only through gravitational force and collide after a time $T = 4$ seconds. If the sides of the triangle are increased to length 2a and also the masses of the spheres are made 2 m, then they will collide after _____ seconds.

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q15 JEE Main 2025 · 2 Apr · Shift 2 Numerical

A satellite of mass 1000 kg is launched to revolve around the earth in an orbit at a height of 270 km from the earth's surface. Kinetic energy of the satellite in this orbit is _____ $\times 10^{10} J$. (Mass of earth $= 6 \times 10^{24} kg$, Radius of earth $= 6.4 \times 10^{6} m$, Gravitational constant $= 6.67 \times 10^{-11} N m^2 kg^{-2}$)

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q16 JEE Main 2025 · 29 Jan · Shift 2 Numerical

Two planets, A and B are orbiting a common star in circular orbits of radii R_A and R_B, respectively, with $R_B = 2R_A$. The planet B is $4\sqrt{2}$ times more massive than planet A. The ratio $\left(\frac{L_B}{L_A}\right)$ of angular momentum (L_B) of planet B to that of planet A (L_A) is closest to integer _____ .

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q17 JEE Main 2025 · 28 Jan · Shift 2 MCQ

Earth has mass 8 times and radius 2 times that of a planet. If the escape velocity from the earth is 11.2 km/s, the escape velocity in km/s from the planet will be :

(A) 2.8
(B) 11.2
(C) 5.6
(D) 8.4

Answer: (C) 5.6 · Key from source paper

Q18 JEE Main 2025 · 24 Jan · Shift 1 MCQ

A satellite is launched into a circular orbit of radius ' R ' around the earth. A second satellite is launched into an orbit of radius 1.03 R . The time period of revolution of the second satellite is larger than the first one approximately by

(A) 9%
(B) 3%
(C) 4.5%
(D) 2.5%

Answer: (C) 4.5% · Key from source paper

Q19 JEE Main 2025 · 24 Jan · Shift 2 Numerical

Acceleration due to gravity on the surface of earth is ' g '. If the diameter of earth is reduced to one third of its original value and mass remains unchanged, then the acceleration due to gravity on the surface of the earth is _____ g.

Numerical value type: the answer is a number.

Answer: 9. · Key from source paper

Q20 JEE Main 2025 · 23 Jan · Shift 2 MCQ

If a satellite orbiting the Earth is 9 times closer to the Earth than the Moon, what is the time period of rotation of the satellite? Given rotational time period of Moon = 27 days and gravitational attraction between the satellite and the moon is neglected.

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(A) 27 days
(B) 1 days
(C) 81 days
(D) 3 days

Answer: (B) 1 days · Key from source paper

Q21 JEE Main 2025 · 23 Jan · Shift 2 Numerical

A satellite of mass $\frac{M}{2}$ is revolving around earth in a circular orbit at a height of $\frac{R}{3}$ from earth surface. The angular momentum of the satellite is $M\sqrt{\frac{GMR}{x}}$. The value of x is _____, where M and R are the mass and radius of earth, respectively. (G is the gravitational constant)

Numerical value type: the answer is a number.

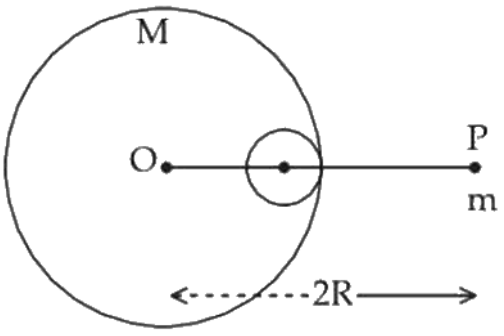
Answer: 3. · Key from source paper

Q22 JEE Main 2025 · 22 Jan · Shift 1 MCQ

A small point of mass m is placed at a distance $2R$ from the centre ' O' of a big uniform solid sphere of mass M and radius R . The gravitational force on ' m ' due to M is F_1. A spherical part of radius R/3 is removed from the big sphere as shown in the figure and the gravitational force on m due to remaining part of M is found to be F_2. The value of ratio $\mathrm{F}_1 : \mathrm{F}_2$ is

(see the figure above)

Q35. A small point of mass m is placed at a distance $2R$ from the centre ' O' of a big uniform solid sphere of mass M and radius R . The gravitational force on ' m ' due to M is F_1. A spherical part of radius $\mathrm{R}/3$ is removed from the big sphere as shown in the figure and the gravitational force on m due to remaining part of M is found



to be F_2. The value of ratio $\mathrm{F}_1 : \mathrm{F}_2$ is

(1) 12 : 11
(2) 11 : 10
(3) 12 : 9
(4) 16 : 9

(A) 12 : 11
(B) 11 : 10
(C) 12 : 9
(D) 16 : 9

Answer: (A) 12 : 11 · Key from source paper

Q23 JEE Main 2025 · 22 Jan · Shift 2 MCQ

Given below are two statements. One is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : A simple pendulum is taken to a planet of mass and radius, 4 times and 2 times, respectively, than the Earth. The time period of the pendulum remains same on earth and the planet. Reason (R): The mass of the pendulum remains unchanged at Earth and the other planet. In the light of the above statements, choose the correct answer from the options given below :

(A) (**A**) is false but (R) is true
(B) (A) is true but (R) is false
(C) Both (**A**) and (**R**) are true and (**R**) is the correct explanation of (**A**)
(D) Both (A) and (R) are true but (R) is NOT the correct explanation of (A)

Answer: (D) Both (A) and (R) are true but (R) is NOT the correct explanation of (A) · Key from source paper

Q24 JEE Main 2024 · 9 Apr · Shift 1 MCQ

An astronaut takes a ball of mass m from earth to space. He throws the ball into a circular orbit about earth at an altitude of 318.5 km. From earth's surface to the orbit, the change in total mechanical energy of the ball is $x\,\frac{\mathrm{GM_e m}}{21\mathrm{R_e}}$. The value of x is (take $\mathrm{R_e}$ = 6370 km) :

(A) 10
(B) 12
(C) 9
(D) 11

Answer: (D) 11 · Key from source paper

Q25 JEE Main 2024 · 9 Apr · Shift 2 MCQ

A satellite of 10^3 kg mass is revolving in circular orbit of radius $2R$. If $\frac{10^4 R}{6}$ J energy is supplied to the satellite, it would revolve in a new circular orbit of radius (use $g = 10$ m/s^2, R = radius of earth)

(A) $2.5R$
(B) $3R$
(C) $4R$
(D) $6R$

Answer: (D) $6R$ · Key from source paper

Q26 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Two planets A and B having masses m_1 and m_2 move around the sun in circular orbits of r_1 and r_2 radii respectively. If angular momentum of A is L and that of B is $3\,\mathrm{L}$, the ratio of time period $\left(\frac{T_A}{T_B}\right)$ is:

(A) $\left(\frac{r_2}{r_1}\right)^{\frac{3}{2}}$
(B) $\frac{1}{27}\left(\frac{m_2}{m_1}\right)^3$
(C) $27\left(\frac{m_1}{m_2}\right)^3$
(D) $\left(\frac{r_1}{r_2}\right)^3$

Answer: (B) $\frac{1}{27}\left(\frac{m_2}{m_1}\right)^3$ · Key from source paper

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Q27 JEE Main 2024 · 8 Apr · Shift 2 MCQ

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) $12v$

Answer: (B) $6v$ · Key from source paper

Q28 JEE Main 2024 · 6 Apr · Shift 1 MCQ

To project a body of mass m from earth's surface to infinity, the required kinetic energy is (assume, the radius of earth is R_E, g = acceleration due to gravity on the surface of earth):

(A) $2mgR_E$
(B) $4mgR_E$
(C) mgR_E
(D) $1/2mgR_E$

Answer: (C) mgR_E · Key from source paper

Q29 JEE Main 2024 · 6 Apr · Shift 2 MCQ

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

(A) 75 N
(B) 300 N
(C) 375 N
(D) 225 N

Answer: (D) 225 N · Key from source paper

Q30 JEE Main 2024 · 5 Apr · Shift 1 MCQ

Match List I with List II :

List I	List II
(A) Kinetic energy of planet	(I) $-GMm/a$
(B) Gravitation Potential energy of sun-planet system	(II) $GMm/2a$
(C) Total mechanical energy of planet	(III) $\frac{Gm}{r}$
(D) Escape energy at the surface of planet for unit mass object	(IV) $-GMm/2a$

(Where a = radius of planet orbit, r = radius of planet, M = mass of Sun, m = mass of planet)
Choose the correct answer from the options given below :

(A) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
(B) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(C) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(D) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

Answer: (B) (A)-(II), (B)-(I), (C)-(IV), (D)-(III) · Key from source paper

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Q31 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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 4.2×10^4 km)

(A) 1.4×10^4 km
(B) 1.05×10^4 km
(C) 8.4×10^4 km
(D) 1.68×10^5 km

Answer: (B) 1.05×10^4 km · Key from source paper

Q32 JEE Main 2024 · 4 Apr · Shift 1 MCQ

A metal wire of uniform mass density having length L and mass M is bent to form a semicircular arc and a particle of mass m is placed at the centre of the arc. The gravitational force on the particle by the wire is :

(A) $\frac{GmM\pi^2}{L^2}$
(B) $\frac{GMm\pi}{2L^2}$
(C) 0
(D) $\frac{2GmM\pi}{L^2}$

Answer: (D) $\frac{2GmM\pi}{L^2}$ · Key from source paper

Q33 JEE Main 2024 · 4 Apr · Shift 2 MCQ

A 90 kg body placed at 2R distance from surface of earth experiences gravitational pull of :
(R = Radius of earth, g = 10 m s^{-2})

(A) 100 N
(B) 300 N
(C) 225 N
(D) 120 N

Answer: (A) 100 N · Key from source paper

Q34 JEE Main 2024 · 4 Apr · Shift 2 MCQ

Correct formula for height of a satellite from earths surface is:

(A) $\left(\frac{T^2R^2}{4\pi^2 g}\right)^{1/3} - R$
(B) $\left(\frac{T^2R^2 g}{4\pi^2}\right)^{1/3} - R$
(C) $\left(\frac{T^2R^2 g}{4\pi^2}\right)^{-1/3} + R$
(D) $\left(\frac{T^2R^2 g}{4\pi}\right)^{1/2} - R$

Answer: (B) $\left(\frac{T^2R^2 g}{4\pi^2}\right)^{1/3} - R$ · Key from source paper

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Q35 JEE Main 2024 · 1 Feb · Shift 1 MCQ

If R is the radius of the earth and the acceleration due to gravity on the surface of earth is $g = \pi^2\ \mathrm{m\ s^{-2}}$, then the length of the second's pendulum at a height $h = 2R$ from the surface of earth will be:

(A) $\frac{2}{9}$ m
(B) $\frac{1}{9}$ m
(C) $\frac{4}{9}$ m
(D) $\frac{8}{9}$ m

Answer: (B) $\frac{1}{9}$ m · Key from source paper

Q36 JEE Main 2024 · 1 Feb · Shift 2 MCQ

A light planet is revolving around a massive star in a circular orbit of radius R with a period of revolution T. If the force of attraction between planet and star is proportional to $R^{-3/2}$ then choose the correct option :

(A) $T^2 \propto R^{5/2}$
(B) $T^2 \propto R^{7/2}$
(C) $T^2 \propto R^{3/2}$
(D) $T^2 \propto R^3$

Answer: (A) $T^2 \propto R^{5/2}$ · Key from source paper

Q37 JEE Main 2024 · 31 Jan · Shift 1 MCQ

Four identical particles of mass m are kept at the four corners of a square. If the gravitational force exerted on one of the masses by the other masses is $\frac{2\sqrt{2}+1}{32}\frac{Gm^2}{L^2}$, the length of the sides of the square is

(A) $\frac{L}{2}$
(B) $4L$
(C) $3L$
(D) $2L$

Answer: (B) $4L$ · Key from source paper

Q38 JEE Main 2024 · 31 Jan · Shift 2 MCQ

The mass of the moon is $\frac{1}{144}$ times the mass of a planet and its diameter $\frac{1}{16}$ times the diameter of a planet. If the escape velocity on the planet is v, the escape velocity on the moon will be:

(A) $\frac{v}{3}$
(B) $\frac{v}{4}$
(C) $\frac{v}{12}$
(D) $\frac{v}{6}$

Answer: (A) $\frac{v}{3}$ · Key from source paper

Q39 JEE Main 2024 · 30 Jan · Shift 1 MCQ

The gravitational potential at a point above the surface of earth is $-5.12 \times 10^7\ \mathrm{J\,kg^{-1}}$ and the acceleration due to gravity at that point is 6. 4 m s^{-2}. Assume that the mean radius of earth to be 6400 km. The height of this point above the earth's surface is:

(A) 1600 km
(B) 540 km
(C) 1200 km
(D) 1000 km

Answer: (A) 1600 km · Key from source paper

Q40 JEE Main 2024 · 30 Jan · Shift 2 MCQ

Escape velocity of a body from earth is 11.2 km s^{-1}. If the radius of a planet be one-third the radius of earth and mass be one-sixth that of earth, the escape velocity from the plate is:

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(A) 11.2 km s^{-1}
(B) 8.4 km s^{-1}
(C) 4.2 km s^{-1}
(D) 7.9 km s^{-1}

Answer: (D) 7.9 km s^{-1} · Key from source paper

Q41 JEE Main 2024 · 30 Jan · Shift 2 Numerical

A simple pendulum is placed at a place where its distance from the earth's surface is equal to the radius of the earth. If the length of the string is 4 m, then the time period of small oscillations will be _____ s. [take $g = \pi^2\ \mathrm{m\,s^{-2}}$]

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q42 JEE Main 2024 · 29 Jan · Shift 1 MCQ

At what distance above and below the surface of the earth a body will have same weight? (Take radius of earth as R)

(A) $\sqrt{5}R - R$
(B) $\frac{\sqrt{3}R-R}{2}$
(C) $\frac{R}{2}$
(D) $\frac{\sqrt{5}R-R}{2}$

Answer: (D) $\frac{\sqrt{5}R-R}{2}$ · Key from source paper

Q43 JEE Main 2024 · 29 Jan · Shift 2 MCQ

A planet takes 200 days to complete one revolution around the Sun. If the distance of the planet from Sun is reduced to one fourth of the original distance, how many days will it take to complete one revolution?

(A) 25
(B) 50
(C) 100
(D) 20

Answer: (A) 25 · Key from source paper

Q44 JEE Main 2024 · 27 Jan · Shift 1 MCQ

The acceleration due to gravity on the surface of earth is g. If the diameter of earth reduces to half of its original value and mass remains constant, then acceleration due to gravity on the surface of earth would be :

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(A) $\frac{g}{4}$
(B) $2g$
(C) $\frac{g}{2}$
(D) $4g$

Answer: (D) $4g$ · Key from source paper

Q45 JEE Main 2023 · 15 Apr · Shift 1 MCQ

A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be: (Given g = acceleration due to gravity on the earth.)

(A) $\sqrt{2gR}$
(B) $\sqrt{gR}$
(C) $\sqrt{4gR}$
(D) $\sqrt{\frac{gR}{2}}$

Answer: (B) $\sqrt{gR}$ · Key from source paper

Q46 JEE Main 2023 · 15 Apr · Shift 1 MCQ

Two identical particles each of mass m go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be :

(A) $\sqrt{\frac{Gm}{a^3}}$
(B) $\sqrt{\frac{Gm}{8a^3}}$
(C) $\sqrt{\frac{Gm}{4a^3}}$
(D) $\sqrt{\frac{Gm}{2a^3}}$

Answer: (C) $\sqrt{\frac{Gm}{4a^3}}$ · Key from source paper

Q47 JEE Main 2023 · 13 Apr · Shift 1 MCQ

A planet having mass $9\,\mathrm{M_e}$ and radius $4\mathrm{R_e}$, where $\mathrm{M_e}$ and $\mathrm{R_e}$ are mass and radius of earth respectively, has escape velocity in km s^{-1} given by: (Given escape velocity on earth $V_e = 11.2 \times 10^3$ m s^{-1})

(A) 67.2
(B) 16.8
(C) 11.2
(D) 33.6

Answer: (B) 16.8 · Key from source paper

Q48 JEE Main 2023 · 13 Apr · Shift 2 MCQ

Two planets A and B of radii R and $1.5\,R$ have densities ρ and $\frac{\rho}{2}$ respectively. The ratio of acceleration due to gravity at the surface of B to A is:

(A) 2 : 3
(B) 2 : 1
(C) 3 : 4
(D) 4 : 3

Answer: (C) 3 : 4 · Key from source paper

Q49 JEE Main 2023 · 13 Apr · Shift 2 MCQ

Given below are two statements:
Statement I : For a planet, if the ratio of mass of the planet to its radius increase, the escape velocity from the planet also increase.
Statement II : Escape velocity is independent of the radius of the planet.
In the light of above statements, choose the most appropriate answer from the options given below

(A) Statement I is incorrect but Statement II is correct
(B) Statement I is correct but statement II is incorrect
(C) Both Statement I and Statement II are incorrect
(D) Both Statement I and Statement II are correct

Answer: (B) Statement I is correct but statement II is incorrect · Key from source paper

Q50 JEE Main 2023 · 12 Apr · Shift 1 MCQ

Two satellites A and B move round the earth in the same orbit. The mass of A is twice the mass of B. The quantity which is same for the two satellites will be

(A) Speed
(B) Kinetic energy
(C) Total energy
(D) Potential energy

Answer: (A) Speed · Key from source paper

Q51 JEE Main 2023 · 12 Apr · Shift 1 MCQ

The ratio of escape velocity of a planet to the escape velocity of earth will be:-
Given: Mass of the planet is 16 times mass of earth and radius of the planet is 4 times the radius of earth.

(A) $4:1$
(B) $1:4$
(C) $1:\sqrt{2}$
(D) $2:1$

Answer: (D) $2:1$ · Key from source paper

Q52 JEE Main 2023 · 11 Apr · Shift 1 MCQ

The radii of two planets A and B are R and $4R$ and their densities are ρ and $\frac{\rho}{3}$ respectively. The ratio of acceleration due to gravity at their surfaces $g_A : g_B$ will be

(A) $4:3$
(B) $1:16$
(C) $3:16$
(D) $3:4$

Answer: (D) $3:4$ · Key from source paper

Q53 JEE Main 2023 · 11 Apr · Shift 2 MCQ

A space ship of mass 2×10^4 kg is launched into a circular orbit close to the earth surface. The additional velocity to be imparted to the space ship in the orbit to overcome the gravitational pull will be (if $g = 10\ \mathrm{m\ s^{-2}}$ and radius of earth $= 6400$ km):

(A) $11.2\left(\sqrt{2}-1\right)\ \mathrm{km\ s^{-1}}$
(B) $8\left(\sqrt{2}-1\right)\ \mathrm{km\ s^{-1}}$
(C) $7.9\left(\sqrt{2}-1\right)\ \mathrm{km\ s^{-1}}$
(D) $7.4\left(\sqrt{2}-1\right)\ \mathrm{km\ s^{-1}}$

Answer: (B) $8\left(\sqrt{2}-1\right)\ \mathrm{km\ s^{-1}}$ · Key from source paper

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Q54 JEE Main 2023 · 11 Apr · Shift 2 MCQ

If V is the gravitational potential due to sphere of uniform density on its surface, then its value at the centre of sphere will be:

(A) $\frac{4}{3}V$
(B) $\frac{V}{2}$
(C) V
(D) $\frac{3V}{2}$

Answer: (D) $\frac{3V}{2}$ · Key from source paper

Q55 JEE Main 2023 · 10 Apr · Shift 1 MCQ

Two satellites of masses m and 3 m revolve around the earth in circular orbits of radii r & 3r respectively. The ratio of orbital speeds of the satellites respectively is

(A) $\sqrt{3} : 1$
(B) $3 : 1$
(C) $9 : 1$
(D) $1 : 1$

Answer: (A) $\sqrt{3} : 1$ · Key from source paper

Q56 JEE Main 2023 · 10 Apr · Shift 1 MCQ

Assuming the earth to be a sphere of uniform mass density, the weight of a body at a depth $d = \frac{R}{2}$ from the surface of earth, if its weight on the surface of earth is 200 N, will be : (Given R = radius of earth)

(A) 300 N
(B) 100 N
(C) 400 N
(D) 500 N

Answer: (B) 100 N · Key from source paper

Q57 JEE Main 2023 · 10 Apr · Shift 2 MCQ

Given below are two statements:
Statement I : Rotation of the earth shows effect on the value of acceleration due to gravity (g).
Statement II : The effect of rotation of the earth on the value of g at the equator is minimum and that at the pole is maximum.
In the light of the above statements, choose the correct answer from the options given below

(A) Statement I is false but statement II is true
(B) Both Statement I and Statement II are true
(C) Both Statement I and Statement II are false
(D) Statement I is true but statement II is false

Answer: (D) Statement I is true but statement II is false · Key from source paper

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Q58 JEE Main 2023 · 10 Apr · Shift 2 MCQ

The time period of a satellite, revolving above earth's surface at a height equal to R will be (Given $g = \pi^2\ \mathrm{m\,s^{-2}}$, R = radius of earth)

(A) $\sqrt{2R}$
(B) $\sqrt{8R}$
(C) $\sqrt{32R}$
(D) $\sqrt{4R}$

Answer: (C) $\sqrt{32R}$ · Key from source paper

Q59 JEE Main 2023 · 8 Apr · Shift 1 MCQ

Given below are two statements:
Statement I: If E be the total energy of a satellite moving around the earth, then its potential energy will be $\frac{E}{2}$.
Statement II: The kinetic energy of a satellite revolving in an orbit is equal to the half the magnitude of total energy E.
In the light of the above statements, choose the most appropriate answer from the options given below.

(A) Statement I is correct but Statement II is incorrect
(B) Statement I is incorrect but Statement II is correct
(C) Both Statement I and Statement II are correct
(D) Both Statement I and Statement II are incorrect

Answer: (D) Both Statement I and Statement II are incorrect · Key from source paper

Q60 JEE Main 2023 · 8 Apr · Shift 1 MCQ

The weight of a body on the earth is 400 N. Then weight of the body when taken to a depth half of the radius of the earth will be:

(A) 200 N
(B) Zero
(C) 100 N
(D) 300 N

Answer: (A) 200 N · Key from source paper

Q61 JEE Main 2023 · 8 Apr · Shift 2 MCQ

The orbital angular momentum of a satellite is L, when it is revolving in a circular orbit at height h from earth surface. If the distance of satellite from the earth centre is increased by eight times to its initial value, then the new angular momentum will be

(A) $8\ \mathrm{L}$
(B) $9\ \mathrm{L}$
(C) $4\ \mathrm{L}$
(D) $3\ \mathrm{L}$

Answer: (D) $3\ \mathrm{L}$ · Key from source paper

Q62 JEE Main 2023 · 8 Apr · Shift 2 MCQ

The acceleration due to gravity at height h above the earth if $h \ll R$ (Radius of earth) is given by

(A) $g' = g\left(1 - \frac{h^2}{2R^2}\right)$
(B) $g' = g\left(1 - \frac{h}{2R}\right)$
(C) $g' = g\left(1 - \frac{2h}{R}\right)$
(D) $g' = g\left(1 - \frac{2h^2}{R^2}\right)$

Answer: (C) $g' = g\left(1 - \frac{2h}{R}\right)$ · Key from source paper

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Q63 JEE Main 2023 · 6 Apr · Shift 1 MCQ

A planet has double the mass of the earth. Its average density is equal to that of the earth. An object weighing W on earth will weigh on that planet:

(A) $2^{\frac{1}{4}}W$
(B) $2^{\frac{1}{3}}W$
(C) $2W$
(D) $2^{\frac{2}{3}}W$

Answer: (B) $2^{\frac{1}{3}}W$ · Key from source paper

Q64 JEE Main 2023 · 6 Apr · Shift 1 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

Assertion A: Earth has atmosphere whereas moon doesn't have any atmosphere.

Reason R: The escape velocity on moon is very small as compared to that on earth.

In the light of the above statements, choose the correct answer from the options given below:

(A) Both A and R are correct but R is NOT the correct explanation of A
(B) A is false but R is true
(C) Both A and R are correct and R is the correct explanation of A
(D) A is true but R is false

Answer: (C) Both A and R are correct and R is the correct explanation of A · Key from source paper

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Q65 JEE Main 2023 · 6 Apr · Shift 2 MCQ

The weight of a body on the surface of the earth is $100\ \mathrm{N}$. The gravitational force on it when taken at a height, from the surface of earth, equal to one-fourth the radius of the earth is:

(A) $64\ \mathrm{N}$
(B) $25\ \mathrm{N}$
(C) $50\ \mathrm{N}$
(D) $100\ \mathrm{N}$

Answer: (A) $64\ \mathrm{N}$ · Key from source paper

Q66 JEE Main 2023 · 6 Apr · Shift 2 MCQ

Choose the incorrect statement from the following:

(A) The speed of satellite in a given circular orbit remains constant
(B) For a planet revolving around the sun in an elliptical orbit, the total energy of the planet remains constant
(C) The linear speed of a planet revolving around the sun remains constant
(D) When a body falls towards earth, the displacement of earth towards the body is negligible

Answer: (C) The linear speed of a planet revolving around the sun remains constant · Key from source paper

Q67 JEE Main 2023 · 1 Feb · Shift 1 MCQ

If earth has a mass nine times and radius twice to the of a planet P. Then $\frac{v_e}{3}\sqrt{x}\ ms^{-1}$ will be the minimum velocity required by a rocket to pull out of gravitational force of P, where v_e is escape velocity on earth. The value of x is

(A) 2
(B) 3
(C) 18
(D) 1

Answer: (A) 2 · Key from source paper

Q68 JEE Main 2023 · 1 Feb · Shift 1 MCQ

Given below are two statements :
Statement-I: Acceleration due to gravity is different at different places on the surface of earth.
Statement-II: Acceleration due to gravity increases as we go down below the earth's surface.
In the light of the above statements, choose the correct answer from the options given below

(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Statement I is false but Statement II is true

Answer: (C) Statement I is true but Statement II is false · Key from source paper

Q69 JEE Main 2023 · 1 Feb · Shift 2 MCQ

The escape velocities of two planets A and B are in the ratio 1 : 2. If the ratio of their radii respectively is 1 : 3, then the ratio of acceleration due to gravity of planet A to the acceleration of gravity of planet B will be:

(A) $\frac{4}{3}$
(B) $\frac{3}{2}$
(C) $\frac{2}{3}$
(D) $\frac{3}{4}$

Answer: (D) $\frac{3}{4}$ · Key from source paper

Q70 JEE Main 2023 · 31 Jan · Shift 1 MCQ

At a certain depth d below surface of earth, value of acceleration due to gravity becomes four times that of its value at a height $3R$ above earth surface. Where R is Radius of earth (Take R = 6400 km). The depth d is equal to

(A) 5260 km
(B) 640 km
(C) 2560 km
(D) 4800 km

Answer: (D) 4800 km · Key from source paper

Q71 JEE Main 2023 · 31 Jan · Shift 2 MCQ

A body weight W, is projected vertically upwards from earth's surface to reach a height above the earth which is equal to nine times the radius of earth. The weight of the body at that height will be:

(A) $\frac{W}{91}$
(B) $\frac{W}{100}$
(C) $\frac{W}{9}$
(D) $\frac{W}{3}$

Answer: (B) $\frac{W}{100}$ · Key from source paper

Q72 JEE Main 2023 · 30 Jan · Shift 1 MCQ

If the gravitational field in the space is given as $-\frac{K}{r^2}$. Taking the reference point to be at $r = 2$ cm with gravitational potential $V = 10$ J kg^{-1}. Find the gravitational potentials at $r = 3$ cm in SI unit (Given, that $K = 6$ J cm kg^{-1})

(A) 9
(B) 11
(C) 12
(D) 10

Answer: (B) 11 · Key from source paper

Q73 JEE Main 2023 · 30 Jan · Shift 2 MCQ

An object is allowed to fall from a height R above the earth, where R is the radius of the earth. Its velocity when it strikes the earth's surface, ignoring air resistance, will be :

(A) $2\sqrt{gR}$
(B) $\sqrt{gR}$
(C) $\sqrt{\frac{gR}{2}}$
(D) $\sqrt{2gR}$

Answer: (B) $\sqrt{gR}$ · Key from source paper

Q74 JEE Main 2023 · 29 Jan · Shift 1 MCQ

Two particles of equal mass m move in a circle of radius r under the action of their mutual gravitational attraction. The speed of each particle will be :

(A) $\sqrt{\frac{Gm}{2r}}$
(B) $\sqrt{\frac{4Gm}{r}}$
(C) $\sqrt{\frac{Gm}{r}}$
(D) $\sqrt{\frac{Gm}{4r}}$

Answer: (D) $\sqrt{\frac{Gm}{4r}}$ · Key from source paper

Q75 JEE Main 2023 · 29 Jan · Shift 2 MCQ

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 hours
(B) 6 hours
(C) 12 hours
(D) 3 hours

Answer: (D) 3 hours · Key from source paper

Q76 JEE Main 2023 · 25 Jan · Shift 1 MCQ

Assume that the earth is a solid sphere of uniform density and a tunnel is dug along its diameter throughout the earth. It is found that when a particle is released in this tunnel, it executes a simple harmonic motion. The mass of the particle is 100 g. The time period of the motion of the particle will be (approximately)
(take $g = 10\ \mathrm{ms}^{-2}$, radius of earth = 6400 km)

(A) 24 hours
(B) 1 hour 24 minutes
(C) 1 hour 40 minutes
(D) 12 hours

Answer: (B) 1 hour 24 minutes · Key from source paper

Q77 JEE Main 2023 · 25 Jan · Shift 2 MCQ

A body of mass is taken from earth surface to the height h equal to twice the radius of earth (R_e), the increase in potential energy will be : (g = acceleration due to gravity on the surface of earth)

(A) $3mgR_e$
(B) $\frac{1}{3}mgR_e$
(C) $\frac{2}{3}mgR_e$
(D) $\frac{1}{2}mgR_e$

Answer: (C) $\frac{2}{3}mgR_e$ · Key from source paper

Q78 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Every planet revolves around the sun in an elliptical orbit :

A. The force acting on a planet is inversely proportional to square of distance from sun.

B. Force acting on planet is inversely proportional to product of the masses of the planet and the sun.

C. The centripetal force acting on the planet is directed away from the sun.

D. The square of time period of revolution of planet around sun is directly proportional to cube of semi-major axis of elliptical orbit.

Choose the correct answer from the options given below :

(A) A and D only
(B) C and D only
(C) B and C only
(D) A and C only

Answer: (A) A and D only · Key from source paper

Q79 JEE Main 2023 · 24 Jan · Shift 1 MCQ

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

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(A) 9.8 N
(B) 4.9 N
(C) 19.6 N
(D) 8 N

Answer: (D) 8 N · Key from source paper

Q80 JEE Main 2023 · 24 Jan · Shift 2 MCQ

Given below are two statements:

Statement I: Acceleration due to earth's gravity decreases as you go 'up' or 'down' from earth's surface.

Statement II: Acceleration due to earth's gravity is same at a height 'h' and depth 'd' from earth's surface, if $h = d$.

In the light of above statements, choose the most appropriate answer form the options given below

(A) Statement I is incorrect but statement II is correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct but statement II is incorrect
(D) Both Statement I and II are correct

Answer: (C) Statement I is correct but statement II is incorrect · Key from source paper

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Q81 JEE Main 2023 · 24 Jan · Shift 2 MCQ

If the distance of the earth from Sun is 1.5×10^6 km, then the distance of an imaginary planet from Sun, if its period of revolution is 2.83 years is:

(A) 6×10^7 km
(B) 6×10^6 km
(C) 3×10^6 km
(D) 3×10^7 km

Answer: (C) 3×10^6 km · Key from source paper

Q82 JEE Main 2022 · 29 Jul · Shift 1 Numerical

If the acceleration due to gravity experienced by a point mass at a height h above the surface of earth is same as that of the acceleration due to gravity at a depth $\alpha h (h \ll R_e)$) from the earth surface. The value of α will be _____.
(use $R_e = 6400$ km)

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

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Q83 JEE Main 2022 · 29 Jul · Shift 2 MCQ

An object of mass 1 kg is taken to a height from the surface of earth which is equal to three times the radius of earth. The gain in potential energy of the object will be [If, $g = 10\ \mathrm{m\,s^{-2}}$ and radius of earth $= 6400$ km]

(A) 48 MJ
(B) 24 MJ
(C) 36 MJ
(D) 12 MJ

Answer: (A) 48 MJ · Key from source paper

Q84 JEE Main 2022 · 28 Jul · Shift 1 MCQ

If the radius of earth shrinks by 2% while its mass remains same. The acceleration due to gravity on the earth's surface will approximately

(A) decrease by 2%
(B) decrease by 4%
(C) increase by 2%
(D) increase by 4%

Answer: (D) increase by 4% · Key from source paper

Q85 JEE Main 2022 · 28 Jul · Shift 2 MCQ

Assume there are two identical simple pendulum Clocks-1 is placed on the earth and Clock-2 is placed on a space station located at a height h above the earth surface. Clock-1 and Clock-2 operate at time periods $4\ \mathrm{s}$ and $6\ \mathrm{s}$ respectively. Then the value of h is -
(consider radius of earth $R_E = 6400\ \mathrm{km}$ and g on earth $10\ \mathrm{m\,s^{-2}}$)

(A) $1200\ \mathrm{km}$
(B) $1600\ \mathrm{km}$
(C) $3200\ \mathrm{km}$
(D) $4800\ \mathrm{km}$

Answer: (C) $3200\ \mathrm{km}$ · Key from source paper

Q86 JEE Main 2022 · 27 Jul · Shift 1 MCQ

Two satellites A and B having masses in the ratio 4 : 3 are revolving in circular orbits of radii $3r$ and $4r$ respectively around the earth. The ratio of total mechanical energy of A to B is

(A) 9 : 16
(B) 16 : 9
(C) 1 : 1
(D) 4 : 3

Answer: (B) 16 : 9 · Key from source paper

Q87 JEE Main 2022 · 27 Jul · Shift 2 MCQ

A body of mass m is projected with velocity λv_e in vertically upward direction from the surface of the earth into space. It is given that v_e is escape velocity and $\lambda < 1$. If air resistance is considered to the negligible, then the maximum height from the centre of earth, to which the body can go, will be (R : radius of earth)

(A) $\frac{R}{1+\lambda^2}$
(B) $\frac{R}{1-\lambda^2}$
(C) $\frac{R}{1-\lambda}$
(D) $\frac{\lambda^2 R}{1-\lambda^2}$

Answer: (B) $\frac{R}{1-\lambda^2}$ · Key from source paper

Q88 JEE Main 2022 · 26 Jul · Shift 1 MCQ

The percentage decrease in the weight of a rocket, when taken to a height of 32 km above the surface of earth will, be
(Radius of earth = 6400 km)

(A) 1%
(B) 3%
(C) 4%
(D) 0.5%

Answer: (A) 1% · Key from source paper

Q89 JEE Main 2022 · 26 Jul · Shift 2 MCQ

A body is projected vertically upwards from the surface of earth with a velocity equal to one third of escape velocity. The maximum height attained by the body will be
(Take radius of earth $= 6400\ \text{km}$ and $g = 10\ \text{ms}^{-2}$)

(A) $800\ \text{km}$
(B) $1600\ \text{km}$
(C) $2133\ \text{km}$
(D) $4800\ \text{km}$

Answer: (A) $800\ \text{km}$ · Key from source paper

Q90 JEE Main 2022 · 25 Jul · Shift 1 MCQ

Three identical particle A, B and C of mass 100 kg each are placed in a straight line with $AB = BC = 13$ m. The gravitational force on a fourth particle P of the same mass is F, when placed at a distance 13 m from the particle B on the perpendicular bisector of the line AC. The value of F will be approximately

(A) $21G$
(B) $100G$
(C) $59G$
(D) $42G$

Answer: (B) $100G$ · Key from source paper

Q91 JEE Main 2022 · 25 Jul · Shift 2 MCQ

The length of a seconds pendulum at a height $h = 2R$ from earth surface will be:
(Given: R = Radius of earth and acceleration due to gravity at the surface of earth $g = \pi^2\ \mathrm{m\,s^{-2}}$)

(A) $\frac{2}{9}\ \mathrm{m}$
(B) $\frac{4}{9}\ \mathrm{m}$
(C) $\frac{8}{9}\ \mathrm{m}$
(D) $\frac{1}{9}\ \mathrm{m}$

Answer: (D) $\frac{1}{9}\ \mathrm{m}$ · Key from source paper

Q92 JEE Main 2022 · 25 Jul · Shift 2 MCQ

An object is taken to a height above the surface of earth at a distance $\frac{5}{4}R$ from the centre of the earth. Where radius of earth, $R = 6400$ km. The percentage decrease in the weight of the object will be

(A) 36%
(B) 50%
(C) 64%
(D) 25%

Answer: (A) 36% · Key from source paper

Q93 JEE Main 2022 · 29 Jun · Shift 1 MCQ

The escape velocity of a body on a planet A is $12\ \mathrm{km\,s^{-1}}$. The escape velocity of the body on another planet B, whose density is four times and radius is half of the planet A, is

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(A) $12\ \mathrm{km\,s^{-1}}$
(B) $24\ \mathrm{km\,s^{-1}}$
(C) $36\ \mathrm{km\,s^{-1}}$
(D) $6\ \mathrm{km\,s^{-1}}$

Answer: (A) $12\ \mathrm{km\,s^{-1}}$ · Key from source paper

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Q94 JEE Main 2022 · 29 Jun · Shift 2 MCQ

The time period of a satellite revolving around earth in a given orbit is 7 hours. If the radius of orbit is increased to three times its previous value, then approximate new time period of the satellite will be

(A) 36 hours
(B) 40 hours
(C) 30 hours
(D) 25 hours

Answer: (A) 36 hours · Key from source paper

Q95 JEE Main 2022 · 28 Jun · Shift 1 MCQ

Two planets A and B of equal mass are having their period of revolutions T_A and T_B such that $T_A = 2T_B$. These planets are revolving in the circular orbits of radii r_A and r_B respectively. Which out of the following would be the correct relationship of their orbits?

(A) $2r_A^2 = r_B^3$
(B) $r_A^3 = 2r_B^3$
(C) $r_A^3 = 4r_B^3$
(D) $T_A^2 - T_B^2 = \dfrac{\pi^2}{GM}\left(r_B^3 - 4r_A^3\right)$

Answer: (C) $r_A^3 = 4r_B^3$ · Key from source paper

Q96 JEE Main 2022 · 28 Jun · Shift 2 MCQ

Two objects of equal masses placed at certain distance from each other attracts each other with a force of F. If one-third mass of one object is transferred to the other object, then the new force will be

(A) $\frac{2}{9}F$
(B) $\frac{16}{9}F$
(C) $\frac{8}{9}F$
(D) F

Answer: (C) $\frac{8}{9}F$ · Key from source paper

Q97 JEE Main 2022 · 27 Jun · Shift 1 MCQ

Statement I : The law of gravitation holds good for any pair of bodies in the universe.
Statement II : The weight of any person becomes zero when the person is at the centre of the earth.
In the light of the above statements, choose the correct answer from the options given below.

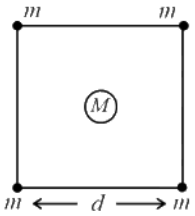
(A) Statement 1 and statement 2 both are true.
(B) Statement 1 is true and statement 2 is false.
(C) Statement 1 and statement 2 both are false.
(D) Statement 1 is false and statement 2 is true.

Answer: (A) Statement 1 and statement 2 both are true. · Key from source paper

Q98 JEE Main 2022 · 27 Jun · Shift 2 MCQ

Four spheres each of mass m form a square of side d (as shown in figure). A fifth sphere of mass M is situated at the centre of square. The total gravitational potential energy of the system is
(see the figure above)

Q7. Four spheres each of mass m form a square of side d (as shown in figure). A fifth sphere of mass M is situated at the centre of square. The total gravitational potential energy of the system is



(1) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)m+4\sqrt{2}M\right]$
(2) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)M+4\sqrt{2}m\right]$
(3) $-\frac{Gm}{d}\left[3m^2+4\sqrt{2}M\right]$
(4) $-\frac{Gm}{d}\left[6m^2+4\sqrt{2}M\right]$

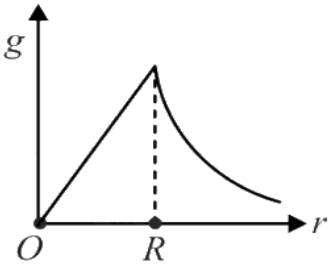
(A) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)m+4\sqrt{2}M\right]$
(B) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)M+4\sqrt{2}m\right]$
(C) $-\frac{Gm}{d}\left[3m^2+4\sqrt{2}M\right]$
(D) $-\frac{Gm}{d}\left[6m^2+4\sqrt{2}M\right]$

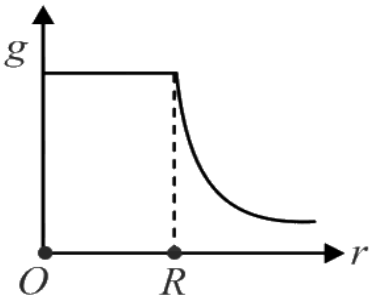
Answer: (A) $-\frac{Gm}{d}\left[\left(4+\sqrt{2}\right)m+4\sqrt{2}M\right]$ · Key from source paper

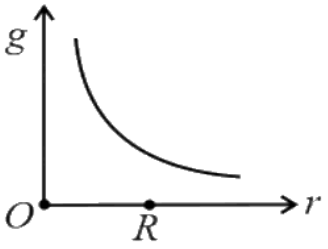
Q99 JEE Main 2022 · 26 Jun · Shift 1 MCQ

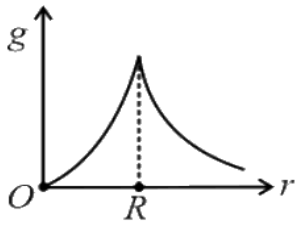
The variation of acceleration due to gravity (g) with distance (r) from the center of the earth is correctly represented by
(Given R = radius of earth)

Q6. The variation of acceleration due to gravity (g) with distance (r) from the center of the earth is correctly represented by
(Given R = radius of earth)

(1)


(2)


(3)


(4)


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q100 JEE Main 2022 · 26 Jun · Shift 2 MCQ

Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: If we move from poles to equator, the direction of acceleration due to gravity always points towards the center of earth without any variation in its magnitude.
Reason R: At equator, the direction of acceleration due to the gravity is towards the center of earth.
In the light of above statements, choose the correct answer from the options given below

(A) Assertion and reason both are correct and reason is correct explanation of assertion.
(B) Assertion and reason both are correct but reason is not correct explanation of assertion.
(C) Assertion is true but reason is false
(D) Assertion is false but reason is true

Answer: (D) Assertion is false but reason is true · Key from source paper

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Q101 JEE Main 2022 · 25 Jun · Shift 1 MCQ

The height of any point P above the surface of earth is equal to diameter of earth. The value of acceleration due to gravity at point P will be : (Given g = acceleration due to gravity at the surface of earth).

(A) $\frac{g}{2}$
(B) $\frac{g}{4}$
(C) $\frac{g}{3}$
(D) $\frac{g}{9}$

Answer: (D) $\frac{g}{9}$ · Key from source paper

Q102 JEE Main 2022 · 25 Jun · Shift 2 Numerical

Two satellites S_1 and S_2 are revolving in circular orbits around a planet with radius $R_1 = 3200\ \text{km}$ and $R_2 = 800\ \text{km}$ respectively. The ratio of speed of satellite S_1 to the speed of satellite S_2 in their respective orbits would be $\frac{1}{x}$ where $x =$

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q103 JEE Main 2022 · 24 Jun · Shift 1 MCQ

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 $\text{R} = 6400\ \text{km}$ and $\sqrt{3} = 1.732$]

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

Answer: (B) $4685\ \text{km}$ · Key from source paper

Q104 JEE Main 2022 · 24 Jun · Shift 2 MCQ

The distance between Sun and Earth is R. The duration of year if the distance between Sun and Earth becomes $3R$ will be :

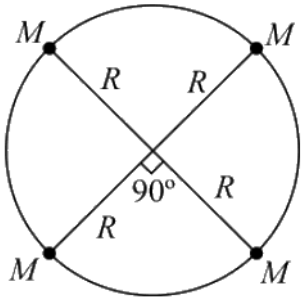
(A) $\sqrt{3}\ \text{yr}$
(B) $3\sqrt{3}\ \text{yr}$
(C) $3\ \text{yr}$
(D) $9\ \text{yr}$

Answer: (B) $3\sqrt{3}\ \text{yr}$ · Key from source paper

Q105 JEE Main 2021 · 1 Sep · Shift 2 MCQ

Four particles each of mass M, move along a circle of radius R under the action of their mutual gravitational attraction as shown in figure. The speed of each particle is :
(see the figure above)

Q7. Four particles each of mass M, move along a circle of radius R under the action of their mutual gravitational attraction as shown in figure. The speed of each particle is :



(1) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}+1}$

(2) $\frac{1}{2}\sqrt{\frac{GM}{R\left(2\sqrt{2}+1\right)}}$

(3) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}-1}$

(4) $\sqrt{\frac{GM}{R}}$

(A) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}+1}$

(B) $\frac{1}{2}\sqrt{\frac{GM}{R\left(2\sqrt{2}+1\right)}}$

(C) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}-1}$

(D) $\sqrt{\frac{GM}{R}}$

Answer: (A) $\frac{1}{2}\sqrt{\frac{GM}{R}2\sqrt{2}+1}$ · Key from source paper

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Q106 JEE Main 2021 · 1 Sep · Shift 2 Numerical

Two satellites revolve around a planet in coplanar circular orbits in anticlockwise direction. Their period of revolutions are 1 hour and 8 hours respectively. The radius of the orbit of nearer satellite is 2×10^3 km. The angular speed of the farther satellite as observed from the nearer satellite at the instant when both the satellites are closest is $\frac{\pi}{x}$ rad h^{-1}, where x is _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q107 JEE Main 2021 · 31 Aug · Shift 1 MCQ

The masses and radii of the earth and moon are $(M_1,\ R_1)$ and $(M_2,\ R_2)$ respectively. Their centres are at a distance r apart. Find the minimum escape velocity for a particle of mass m to be projected from the middle of these two masses :

(A) $v_e = \sqrt{\frac{4G(M_1+M_2)}{r}}$

(B) $v_e = \frac{1}{2}\sqrt{\frac{2G(M_1+M_2)}{r}}$

(C) $v_e = \frac{1}{2}\sqrt{\frac{4G(M_1+M_2)}{r}}$

(D) $v_e = \frac{\sqrt{2G(M_1+M_2)}}{r}$

Answer: (A) $v_e = \sqrt{\frac{4G(M_1+M_2)}{r}}$ · Key from source paper

Q108 JEE Main 2021 · 31 Aug · Shift 2 MCQ

If R_E be the radius of Earth, then the ratio between the acceleration due to gravity at a depth r below and a height r above the earth surface is:
(Given : $r < R_E$)

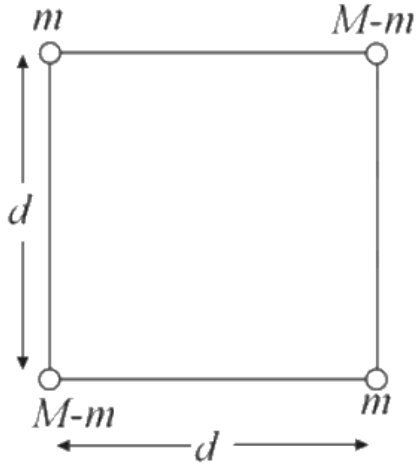
(A) $1 + \frac{r}{R_E} - \frac{r^2}{R_E^2} - \frac{r^3}{R_E^3}$
(B) $1 + \frac{r}{R_E} + \frac{r^2}{R_E^2} + \frac{r^3}{R_E^3}$
(C) $1 - \frac{r}{R_E} - \frac{r^2}{R_E^2} - \frac{r^3}{R_E^3}$
(D) $1 + \frac{r}{R_E} - \frac{r^2}{R_E^2} + \frac{r^3}{R_E^3}$

Answer: (A) $1 + \frac{r}{R_E} - \frac{r^2}{R_E^2} - \frac{r^3}{R_E^3}$ · Key from source paper

Q109 JEE Main 2021 · 27 Aug · Shift 1 Numerical

A body of mass $(2M)$ splits into four masses $\{m, M-m, m, M-m\}$, which are rearranged to form a square as shown in the figure. The ratio of $\frac{M}{m}$ for which, the gravitational potential energy of the system becomes maximum is x : 1. The value of x is _____.
(see the figure above)

Q23. A body of mass $(2M)$ splits into four masses $\{m, M-m, m, M-m\}$, which are rearranged to form a square as shown in the figure. The ratio of $\frac{M}{m}$ for which, the gravitational potential energy of the system becomes maximum is x : 1. The value of x is _____.



Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q110 JEE Main 2021 · 27 Aug · Shift 2 MCQ

A mass of $50\ \text{kg}$ is placed at the center of a uniform spherical shell of mass $100\ \text{kg}$ and radius $50\ \text{m}$. If the gravitational potential at a point, $25\ \text{m}$ from the center is $V\ \text{kg m}^{-1}$. The value of V is:

(A) $+2G$
(B) $-20G$
(C) $-4G$
(D) $-60G$

Answer: (C) $-4G$ · Key from source paper

Q111 JEE Main 2021 · 26 Aug · Shift 1 MCQ

Inside a uniform spherical shell :
(a) The gravitational field is zero.
(b) The gravitational potential is zero.
(c) The gravitational field is the same everywhere.
(d) The gravitation potential is the same everywhere.
(e) All the above.
Choose the most appropriate answer from the options given below:

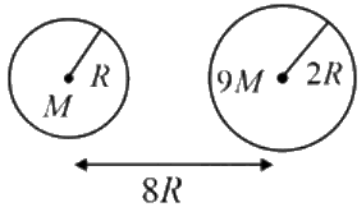
(A) (a), (c) and (d) only
(B) (a), (b) and (c) only
(C) (b), (c) and (d) only
(D) (e) only

Answer: (A) (a), (c) and (d) only · Key from source paper

Q112 JEE Main 2021 · 27 Jul · Shift 1 Numerical

Suppose two planets (spherical in shape) of radii R and $2R$, but mass M and $9M$ respectively have a centre to centre separation $8R$ as shown in the figure. A satellite of mass m is projected from the surface of the planet of mass M directly towards the centre of the second planet. The minimum speed v required for the satellite to reach the surface of the second planet is $\sqrt{\frac{a}{7}\frac{GM}{R}}$, then the value of a is
[Given : The two planets are fixed in their position]
(see the figure above)

Q21. Suppose two planets (spherical in shape) of radii R and $2R$, but mass M and $9M$ respectively have a centre to centre separation $8R$ as shown in the figure. A satellite of mass m is projected from the surface of the planet of mass M directly towards the centre of the second planet. The minimum speed v required for the satellite to reach the surface of the second planet is $\sqrt{\frac{a}{7}\frac{GM}{R}}$, then the value of a is
[Given : The two planets are fixed in their position]



Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q113 JEE Main 2021 · 27 Jul · Shift 2 MCQ

Two identical particles of mass $1\ \text{kg}$ each go round a circle of radius R, under the action of their mutual gravitational attraction. The angular speed of each particle is:

(A) $\sqrt{\frac{G}{2R^3}}$

(B) $\frac{1}{2}\sqrt{\frac{G}{R^3}}$

(C) $\frac{1}{2R}\sqrt{\frac{1}{G}}$

(D) $\sqrt{\frac{2G}{R^3}}$

Answer: (B) $\frac{1}{2}\sqrt{\frac{G}{R^3}}$ · Key from source paper

Q114 JEE Main 2021 · 27 Jul · Shift 2 MCQ

The planet Mars has two moons, if one of them has a period 7 hours, 30 minutes and an orbital radius of $9.0 \times 10^3\ \text{km}$. Find the mass of Mars.
$\left\{\text{Given } \frac{4\pi^2}{G} = 6 \times 10^{11}\ \text{N}^{-1}\ \text{m}^{-2}\ \text{kg}^2\right\}$

(A) $5.96 \times 10^{19}\ \text{kg}$

(B) $3.25 \times 10^{21}\ \text{kg}$

(C) $7.02 \times 10^{25}\ \text{kg}$

(D) $6.00 \times 10^{23}\ \text{kg}$

Answer: (D) $6.00 \times 10^{23}\ \text{kg}$ · Key from source paper

Q115 JEE Main 2021 · 25 Jul · Shift 1 MCQ

The minimum and maximum distances of a planet revolving around the Sun are x_1 and x_2. If the minimum speed of the planet on its trajectory is v_0, then its maximum speed will be:

(A) $\frac{v_0 x_1^2}{x_2^2}$

(B) $\frac{v_0 x_2^2}{x_1^2}$

(C) $\frac{v_0 x_1}{x_2}$

(D) $\frac{v_0 x_2}{x_1}$

Answer: (D) $\frac{v_0 x_2}{x_1}$ · Key from source paper

Q116 JEE Main 2021 · 25 Jul · Shift 2 MCQ

Consider a planet in some solar system that has a mass double the mass of earth and density equal to the average density of the earth. If the weight of an object on earth is W, the weight of the same object on that planet will be:

(A) $2W$
(B) W
(C) $2^{\frac{1}{3}}W$
(D) $\sqrt{2}\,W$

Answer: (C) $2^{\frac{1}{3}}W$ · Key from source paper

Q117 JEE Main 2021 · 22 Jul · Shift 1 MCQ

A body is projected vertically upwards from the surface of earth with a velocity sufficient enough to carry it to infinity. The time taken by it to reach height h is _____ S.

(A) $\sqrt{\frac{R_e}{2g}}\left[\left(1+\frac{h}{R_e}\right)^{\frac{3}{2}}-1\right]$
(B) $\sqrt{\frac{2R_e}{g}}\left[\left(1+\frac{h}{R_e}\right)^{\frac{3}{2}}-1\right]$
(C) $\frac{1}{3}\sqrt{\frac{R_e}{2g}}\left[\left(1+\frac{h}{R_e}\right)^{\frac{3}{2}}-1\right]$
(D) $\frac{1}{3}\sqrt{\frac{2R_e}{g}}\left[\left(1+\frac{h}{R_e}\right)^{\frac{3}{2}}-1\right]$

Answer: (D) $\frac{1}{3}\sqrt{\frac{2R_e}{g}}\left[\left(1+\frac{h}{R_e}\right)^{\frac{3}{2}}-1\right]$ · Key from source paper

Q118 JEE Main 2021 · 20 Jul · Shift 1 MCQ

A person whose mass is $100\ \mathrm{kg}$ travels from Earth to Mars in a spaceship. Neglect all other objects in sky and take acceleration due to gravity on the surface of the Earth and Mars as $10\ \mathrm{m\,s^{-2}}$ and $4\ \mathrm{m\,s^{-2}}$, respectively. Identify from the below figures, the curve that fits best for the weight of the passenger as a function of time.

(see the figure above)

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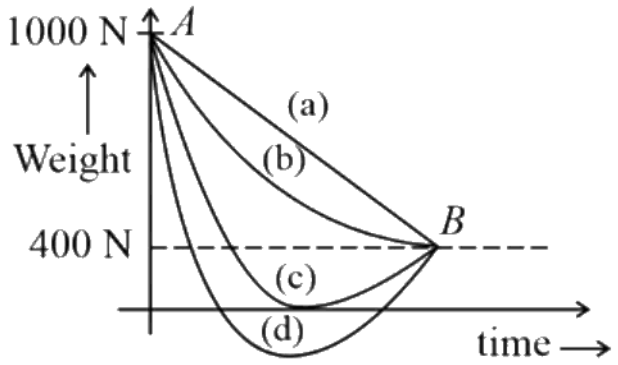
Q5. A person whose mass is 100 kg travels from Earth to Mars in a spaceship. Neglect all other objects in sky and take acceleration due to gravity on the surface of the Earth and Mars as 10 m s^{-2} and 4 m s^{-2}, respectively. Identify from the below figures, the curve that fits best for the weight of the passenger as a function of time.



(1) (c) (2) (a)
(3) (d) (4) (b)

A (c)
B (a)
C (d)
D (b)

Answer: (A) (c) · Key from source paper

Q119 JEE Main 2021 · 20 Jul · Shift 2 MCQ

A satellite is launched into a circular orbit of radius R around earth, while a second satellite is launched into a circular orbit of radius $1.02\,R$. The percentage difference in the time periods of the two satellites is:

A 1.5
B 2.0
C 0.7
D 3.0

Answer: (D) 3.0 · Key from source paper

Q120 JEE Main 2021 · 20 Jul · Shift 2 MCQ

Consider a binary star system of star A and star B with masses m_{A} and m_{B} revolving in a circular orbit of radii r_{A} and r_{B}, respectively. If T_{A} and T_{B} are the time period of star A and star B, respectively, then:

(A) $\frac{T_A}{T_B} = \left(\frac{r_A}{r_B}\right)^{\frac{3}{2}}$

(B) $T_A = T_B$

(C) $T_A > T_B$ (if $m_A > m_B$)

(D) $T_A > T_B$ (if $r_A > r_B$)

Answer: (B) $T_A = T_B$ · Key from source paper

Q121

JEE Main 2021 · 18 Mar · Shift 1 · MCQ

The time period of a satellite in a circular orbit of the radius R is T. The period of another satellite in a circular orbit of the radius $9R$ is:

(A) $9T$

(B) $27T$

(C) $12T$

(D) $3T$

Answer: (B) $27T$ · Key from source paper

Q122

JEE Main 2021 · 18 Mar · Shift 2 · MCQ

If the angular velocity of earth's spin is increased such that the bodies at the equator start floating, the duration of the day would be approximately :
(Take : $g = 10\ \text{ms}^{-2}$, the radius of earth, $R = 6400 \times 10^3\ \text{m}$, Take $\pi = 3.14$)

(A) 60 minutes

(B) does not change

(C) 1200 minutes

(D) 84 minutes

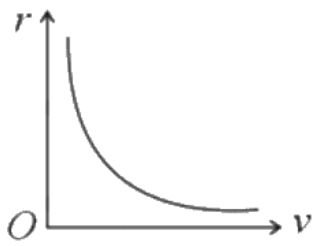
Answer: (D) 84 minutes · Key from source paper

Q123

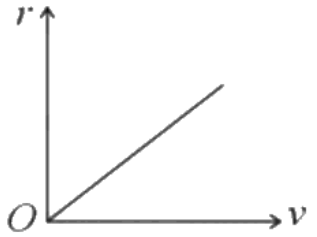
JEE Main 2021 · 18 Mar · Shift 2 · MCQ

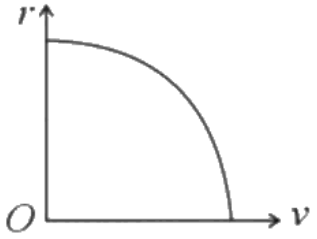
A particle of mass m moves in a circular orbit under the central potential field, $U(r) = \frac{-C}{r}$, where C is a positive constant. The correct radius - velocity graph of the particle's motion is :

Q3. A particle of mass m moves in a circular orbit under the central potential field, $U(r) = \frac{-C}{r}$, where C is a positive constant. The correct radius - velocity graph of the particle's motion is :

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q124 JEE Main 2021 · 18 Mar · Shift 2 MCQ

The angular momentum of a planet of mass M moving around the sun in an elliptical orbit is $\vec{L}$. The magnitude of the areal velocity of the planet is :

(A) $\frac{4L}{M}$
(B) $\frac{L}{M}$
(C) $\frac{2L}{M}$
(D) $\frac{L}{2M}$

Answer: (D) $\frac{L}{2M}$ · Key from source paper

Q125 JEE Main 2021 · 17 Mar · Shift 1 Numerical

The radius in kilometer to which the present radius of earth ($R = 6400\ \text{km}$) to be compressed so that the escape velocity is increased 10 time is _____.

Numerical value type: the answer is a number.

Answer: 64. · Key from source paper

Q126 JEE Main 2021 · 17 Mar · Shift 2 MCQ

A geostationary satellite is orbiting around an arbitrary planet P at a height of $11R$ above the surface of P, R being the radius of P. The time period of another satellite in hours at a height of $2R$ from the

surface of P is _____ has the time period of 24 hours.

(A) $6\sqrt{2}$

(B) $\frac{6}{\sqrt{2}}$

(C) 3

(D) 5

Answer: (C) 3 · Key from source paper

Q127 JEE Main 2021 · 16 Mar · Shift 1 MCQ

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

(A) 1.5×10^{3} m s^{-1}

(B) 6.6×10^{3} m s^{-1}

(C) 3.0×10^{3} m s^{-1}

(D) 4.5×10^{3} m s^{-1}

Answer: (C) 3.0×10^{3} m s^{-1} · Key from source paper

Q128 JEE Main 2021 · 16 Mar · Shift 2 Numerical

If one wants to remove all the mass of the earth to infinity in order to break it up completely. The amount of energy that needs to be supplied will be $\frac{x}{5}\frac{GM^2}{R}$ where x is _____. (Round off to the Nearest Integer)

(M is the mass of earth, R is the radius of earth, G is the gravitational constant)

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q129 JEE Main 2021 · 26 Feb · Shift 1 MCQ

A planet revolving in elliptical orbit has :

A. a constant velocity of revolution.

B. has the least velocity when it is nearest to the sun.

C. its areal velocity is directly proportional to its velocity.

D. areal velocity is inversely proportional to its velocity.

E. to follow a trajectory such that the areal velocity is constant.

Choose the correct answer from the options given below:

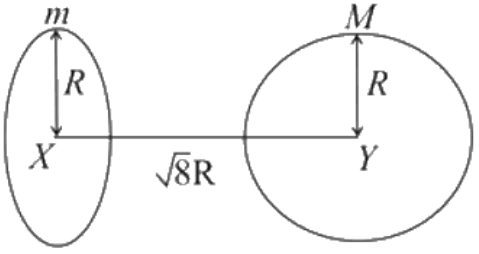
(A) A only
(B) C only
(C) E only
(D) D only

Answer: (C) E only · Key from source paper

Q130 JEE Main 2021 · 26 Feb · Shift 1 MCQ

Find the gravitational force of attraction between the ring and sphere as shown in the diagram, where the plane of the ring is perpendicular to the line joining the centres. If $\sqrt{8}R$ is the distance between the centres of a ring (of mass m) and a sphere (mass M) where both have equal radius R
(see the figure above)

Q7. Find the gravitational force of attraction between the ring and sphere as shown in the diagram, where the plane of the ring is perpendicular to the line joining the centres. If $\sqrt{8}R$ is the distance between the centres of a ring (of mass m) and a sphere (mass M) where both have equal radius R



(1) $\frac{2\sqrt{2}}{3}\frac{GMm}{R^2}$
(2) $\frac{\sqrt{8}}{9}\frac{GmM}{R}$
(3) $\frac{1}{3\sqrt{8}}\frac{GMm}{R^2}$
(4) $\frac{\sqrt{8}}{27}\frac{GmM}{R^2}$

(A) $\frac{2\sqrt{2}}{3}\frac{GMm}{R^2}$
(B) $\frac{\sqrt{8}}{9}\frac{GmM}{R}$
(C) $\frac{1}{3\sqrt{8}}\frac{GMm}{R^2}$
(D) $\frac{\sqrt{8}}{27}\frac{GmM}{R^2}$

Answer: (D) $\frac{\sqrt{8}}{27}\frac{GmM}{R^2}$ · Key from source paper

Q131 JEE Main 2021 · 26 Feb · Shift 1 MCQ

Assume that a tunnel is dug along a chord of the earth, at a perpendicular distance $\frac{R}{2}$ from the earth's centre, where R is the radius of the earth. The wall of the tunnel is frictionless. If a particle is released in this tunnel, it will execute a simple harmonic motion with a time period:

(A) $\frac{1}{2\pi}\sqrt{\frac{g}{R}}$

(B) $2\pi\sqrt{\frac{R}{g}}$

(C) $\frac{g}{2\pi R}$

(D) Image is virtual, opposite side of convex mirror.

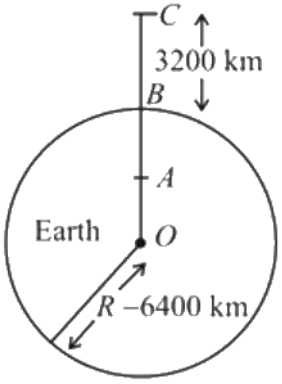
Answer: (B) $2\pi\sqrt{\frac{R}{g}}$ · Key from source paper

Q132 JEE Main 2021 · 26 Feb · Shift 2 Numerical

In the reported figure of earth, the value of acceleration due to gravity is same at point A and C but it is smaller than that of its value at point B (surface of the earth). The value of $OA : AB$ will be $x : 5$. The value of x is

(see the figure above)

Q21. In the reported figure of earth, the value of acceleration due to gravity is same at point A and C but it is smaller than that of its value at point B (surface of the earth). The value of $OA : AB$ will be $x : 5$. The value of x is



Numerical value type: the answer is a number.

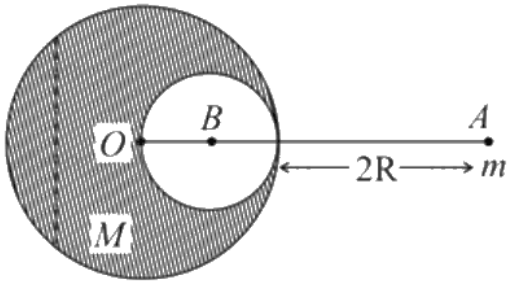
Answer: 4. · Key from source paper

Q133 JEE Main 2021 · 25 Feb · Shift 1 MCQ

A solid sphere of radius R gravitationally attracts a particle placed at $3R$ from its centre with a force F_1. Now a spherical cavity of radius $\left(\frac{R}{2}\right)$ is made in the sphere (as shown in figure) and the force becomes F_2. The value of $F_1 : F_2$ is:

(see the figure above)

Q4. A solid sphere of radius R gravitationally attracts a particle placed at $3R$ from its centre with a force F_1. Now a spherical cavity of radius $\left(\frac{R}{2}\right)$ is made in the sphere (as shown in figure) and the force becomes F_2. The value of $F_1 : F_2$ is:



(1) $41 : 50$
(2) $50 : 41$
(3) $25 : 36$
(4) $36 : 25$

(A) $41 : 50$
(B) $50 : 41$
(C) $25 : 36$
(D) $36 : 25$

Answer: (B) $50 : 41$ · Key from source paper

Q134

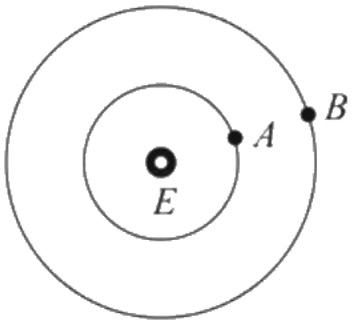
JEE Main 2021 · 25 Feb · Shift 1 | MCQ

Two satellites A and B of masses 200 kg and 400 kg are revolving round the earth at height of 600 km and 1600 km respectively. If T_A and T_B are the time periods of A and B respectively then the value of $T_B - T_A$:

(see the figure above)

[Given : radius of earth $= 6400$ km, mass of earth $= 6 \times 10^{24}$ kg]

Q5. Two satellites A and B of masses 200 kg and 400 kg are revolving round the earth at height of 600 km and 1600 km respectively. If T_A and T_B are the time periods of A and B respectively then the value of $T_B - T_A$:



[Given : radius of earth $= 6400$ km, mass of earth $= 6 \times 10^{24}$ kg]

(1) 4.24×10^3 s
(2) 3.33×10^2 s
(3) 1.33×10^3 s
(4) 4.24×10^2 s

(A) 4.24×10^3 s
(B) 3.33×10^2 s
(C) 1.33×10^3 s
(D) 4.24×10^2 s

Answer: (C) 1.33×10^3 s · Key from source paper

Q135 JEE Main 2021 · 25 Feb · Shift 1 MCQ

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R. Assertion A : The escape velocities of planet A and B are same. But A and B are of unequal mass. Reason R: The product of their mass and radius must be same. $M_1R_1 = M_2R_2$ In the light of the above statements, choose the most appropriate answer from the options given below :

(A) Both A and R are correct and R is the correct explanation of A
(B) Both A and R are correct but R is NOT the correct explanation of A
(C) A is not correct but R is correct
(D) A is correct but R is not correct

Answer: (D) A is correct but R is not correct · Key from source paper

Q136 JEE Main 2021 · 25 Feb · Shift 2 Numerical

The initial velocity v_i required to project a body vertically upward from the surface of the earth to reach a height of $10R$, where R is the radius of the earth, may be described in terms of escape velocity v_e such that $v_i = \sqrt{\frac{x}{y}} \times v_e$. The value of x will be

Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q137 JEE Main 2021 · 24 Feb · Shift 1 MCQ

Consider two satellites S_1 and S_2 with periods of revolution $1\,\text{hr}$ and $8\,\text{hr}$ respectively revolving around a planet in circular orbits. The ratio of angular velocity of satellite S_1 to the angular velocity of satellite S_2 is:

(A) $8 : 1$
(B) $2 : 1$
(C) $1 : 4$
(D) $1 : 8$

Answer: (A) $8 : 1$ · Key from source paper

Q138 JEE Main 2021 · 24 Feb · Shift 1 MCQ

Four identical particles of equal masses $1\,\text{kg}$ made to move along the circumference of a circle of radius $1\,\text{m}$ under the action of their own mutual gravitational attraction. The speed of each particle

will be:

(A) $\sqrt{G1+2\sqrt{2}}$

(B) $\sqrt{\frac{G}{2}1+2\sqrt{2}}$

(C) $\sqrt{\frac{G}{2}2\sqrt{2}-1}$

(D) $\frac{\sqrt{1+2\sqrt{2}G}}{2}$

Answer: (D) $\frac{\sqrt{1+2\sqrt{2}G}}{2}$ · Key from source paper

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Q139 JEE Main 2021 · 24 Feb · Shift 1 MCQ

Two stars of masses m and $2m$ at a distance d rotate about their common centre of mass in free space. The period of revolution is

(A) $2\pi\sqrt{\frac{d^3}{3Gm}}$

(B) $2\pi\sqrt{\frac{3Gm}{d^3}}$

(C) $\frac{1}{2\pi}\sqrt{\frac{3Gm}{d^3}}$

(D) $\frac{1}{2\pi}\sqrt{\frac{d^3}{3Gm}}$

Answer: (A) $2\pi\sqrt{\frac{d^3}{3Gm}}$ · Key from source paper

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Q140 JEE Main 2021 · 24 Feb · Shift 2 MCQ

A body weighs $49\ \text{N}$ on a spring balance at the north pole. What will be its weight recorded on the same weighing machine, if it is shifted to the equator?
[Use $g=\frac{GM}{R^2}=9.8\ \text{m s}^{-2}$ and radius of earth, $R=6400\ \text{km}$.]

(A) $49.17\ \text{N}$

(B) $48.83\ \text{N}$

(C) $49.83\ \text{N}$

(D) $49\ \text{N}$

Answer: (B) $48.83\ \text{N}$ · Key from source paper

Q141 JEE Main 2020 · 6 Sep · Shift 1 MCQ

A satellite is in an elliptical orbit around a planet P. It is observed that the velocity of the satellite when it is farthest from the planet is 6 times less than that when it is closest to the planet. The ratio of distances between the satellite and the planet at closest and farthest points is :

(A) $1:6$
(B) $1:3$
(C) $1:2$
(D) $3:4$

Answer: (A) $1:6$ · Key from source paper

Q142 JEE Main 2020 · 6 Sep · Shift 2 MCQ

Two planets have masses M and 16 M and their radii are a and 2a, respectively. The separation between the centres of the planets is 10a. A body of mass m is fired from the surface of the larger planet towards the smaller planet along the line joining their centres. For the body to be able to reach at the surface of smaller planet, the minimum firing speed needed is :

(A) $2\sqrt{\frac{GM}{a}}$
(B) $4\sqrt{\frac{GM}{a}}$
(C) $\sqrt{\frac{GM^2}{ma}}$
(D) $\frac{3}{2}\sqrt{\frac{5GM}{a}}$

Answer: (D) $\frac{3}{2}\sqrt{\frac{5GM}{a}}$ · Key from source paper

Q143 JEE Main 2020 · 5 Sep · Shift 1 MCQ

The value of the acceleration due to gravity is g_1 at a height $h = \frac{R}{2}$ (R = radius of the earth) from the surface of the earth. It is again equal to g_1 at a depth d below the surface the earth. The ratio $\left(\frac{d}{R}\right)$ equals:

(A) $\frac{4}{9}$
(B) $\frac{5}{9}$
(C) $\frac{1}{3}$
(D) $\frac{7}{9}$

Answer: (B) $\frac{5}{9}$ · Key from source paper

Q144 JEE Main 2020 · 5 Sep · Shift 2 MCQ

The acceleration due to gravity on the earth's surface at the poles is g and angular velocity of the earth about the axis passing through the pole is ω. An object is weighed at the equator and at a height h above the poles by using a spring balance. If the weights are found to be same, then h is: ($h \ll R$, where R is the radius of the earth)

(A) $\frac{R^2\omega^2}{2g}$
(B) $\frac{R^2\omega^2}{g}$
(C) $\frac{R^2\omega^2}{4g}$
(D) $\frac{R^2\omega^2}{8g}$

Answer: (A) $\frac{R^2\omega^2}{2g}$ · Key from source paper

Q145 JEE Main 2020 · 4 Sep · Shift 1 MCQ

On the x-axis and at a distance x from the origin, the gravitational field due to a mass distribution is given by $\frac{Ax}{(x^2+a^2)^{3/2}}$ in the x-direction. The magnitude of the gravitational potential on the x-axis at a distance x, taking its value to be zero at infinity is:

(A) $\frac{A}{(x^2+a^2)^{1/2}}$
(B) $\frac{A}{(x^2+a^2)^{3/2}}$
(C) $A\left(x^2+a^2\right)^{1/2}$
(D) $A\left(x^2+a^2\right)^{3/2}$

Answer: (A) $\frac{A}{(x^2+a^2)^{1/2}}$ · Key from source paper

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Q146 JEE Main 2020 · 4 Sep · Shift 2 MCQ

A body is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the ratio of the speed of this body in the orbit to the escape velocity from the planet is:

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

Answer: (A) $\frac{1}{\sqrt{2}}$ · Key from source paper

Q147 JEE Main 2020 · 3 Sep · Shift 1 MCQ

A satellite is moving in a low nearly circular orbit around the earth. Its radius is roughly equal to that of the earth's radius $\mathrm{R_e}$. By firing rockets attached to it, its speed is instantaneously increased in the direction of its motion so that it become $\sqrt{\frac{3}{2}}$ times larger. Due to this the farthest distance from the centre of the earth that the satellite reaches is R. Value of R is :

(A) $4R_e$
(B) $2.5R_e$
(C) $3R_e$
(D) $2R_e$

Answer: (C) $3R_e$ · Key from source paper

Q148 JEE Main 2020 · 3 Sep · Shift 2 MCQ

The mass density of a planet of radius R varies with the distance r from its centre as $\rho(r) = \rho_0\left(1-\frac{r^2}{R^2}\right)$ Then the gravitational field is maximum at:

(A) $r=\sqrt{\frac{3}{4}}R$
(B) $r=R$
(C) $r=\frac{1}{\sqrt{3}}R$
(D) $r=\sqrt{\frac{5}{9}}R$

Answer: (D) $r=\sqrt{\frac{5}{9}}R$ · Key from source paper

Q149 JEE Main 2020 · 2 Sep · Shift 1 MCQ

The mass density of a spherical galaxy varies as $\frac{K}{r}$ over a large distance r from its center. In that region, a small star is in a circular orbit of radius R. Then the period of revolution,T depends on R as:

(A) $T^2 \propto R$
(B) $T^2 \propto R^3$
(C) $T^2 \propto \frac{1}{R^3}$
(D) $T \propto R$

Answer: (A) $T^2 \propto R$ · Key from source paper

Q150 JEE Main 2020 · 2 Sep · Shift 2 MCQ

The height 'h' at which the weight of a body will be the same as that at the same depth 'h' from the surface of the earth is (Radius of the earth is R and effect of the rotation of the earth is neglected)

(A) $\frac{\sqrt{5}}{2}R-R$
(B) $\frac{R}{2}$
(C) $\frac{\sqrt{5}R-R}{2}$
(D) $\frac{\sqrt{3}R-R}{2}$

Answer: (C) $\frac{\sqrt{5}R-R}{2}$ · Key from source paper

Q151 JEE Main 2020 · 9 Jan · Shift 1 MCQ

A body A of mass m is moving in a circular orbit of radius R about a planet. Another body B of mass $\frac{m}{2}$ collides with A with a velocity which is half $\left(\frac{\vec{v}}{2}\right)$ the instantaneous velocity $\vec{v}$ of A. The collision is completely inelastic. Then, the combined body:

(A) continues to move in a circular orbit
(B) Escapes from the Planet's Gravitational field
(C) Falls vertically downwards towards the planet
(D) starts moving in an elliptical orbit around the planet

Answer: (D) starts moving in an elliptical orbit around the planet · Key from source paper

Q152 JEE Main 2020 · 9 Jan · Shift 2 MCQ

Planet A has mass M and radius R. Planet B has half the mass and half the radius of Planet A. If the escape velocities from the Planets A and B are v_A and v_B, respectively, then $\frac{v_A}{v_B} = \frac{n}{4}$. The value of n is:

(A) 4
(B) 1
(C) 2
(D) 3

Answer: (A) 4 · Key from source paper

Q153 JEE Main 2020 · 8 Jan · Shift 1 MCQ

Consider two solid spheres of radii $R_1 = 1\ \mathrm{m}, R_2 = 2\ \mathrm{m}$ and masses M_1 and M_2, respectively. The gravitational field due to sphere (1) and (2) are shown. The value of $\frac{M_1}{M_2}$ is:
(see the figure above)

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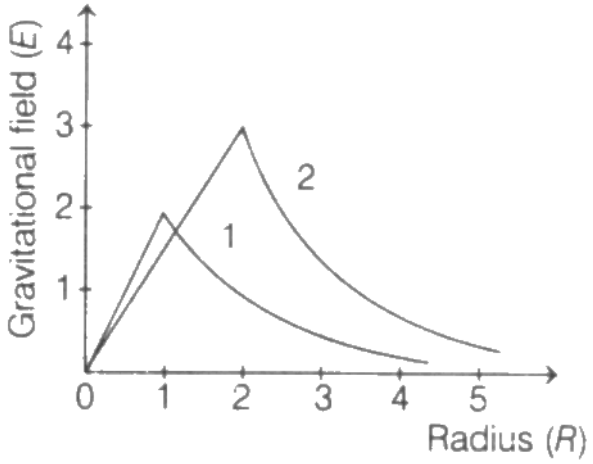
Q5. Consider two solid spheres of radii $R_1 = 1\ \text{m}, R_2 = 2\ \text{m}$ and masses M_1 and M_2, respectively. The gravitational field due to sphere (1) and (2) are shown. The value of $\frac{M_1}{M_2}$ is:



(1) $\frac{2}{3}$
(2) $\frac{1}{6}$
(3) $\frac{1}{2}$
(4) $\frac{1}{3}$

A $\frac{2}{3}$
B $\frac{1}{6}$
C $\frac{1}{2}$
D $\frac{1}{3}$

Answer: (B) $\frac{1}{6}$ · Key from source paper

Q154 JEE Main 2020 · 8 Jan · Shift 2 Numerical

An asteroid is moving directly towards the centre of the earth. When at a distance of $10R$ (R is the radius of the earth) from the centre of the earth, it has a speed of $12\ \text{km s}^{-1}$. Neglecting the effect of earth's atmosphere, what will be the speed of the asteroid when it hits the surface of the earth (escape velocity from the earth is $11.2\ \text{km s}^{-1}$) ? Give your answer to the nearest integer in km s^{-1} _____.

Numerical value type: the answer is a number.

Answer: 16. · Key from source paper

Q155 JEE Main 2020 · 7 Jan · Shift 1 MCQ

A satellite of mass$M$ is launched vertically upwards with an initial speed u from the surface of the earth. After it reaches height R ($R =$ radius of the earth), it ejects a rocket of mass $\frac{M}{10}$ so that subsequently the satellite moves in a circular orbit. The kinetic energy of the rocket is (G is the gravitational constant; M_e is the mass of the earth):

(A) $\frac{M}{20}\left(u^2+\frac{113}{200}\frac{GM_e}{R}\right)$
(B) $5M\left(u^2-\frac{119}{200}\frac{GM_e}{R}\right)$
(C) $\frac{3M}{8}\left(u+\sqrt{\frac{5GM_e}{6R}}\right)^2$
(D) $\frac{M}{20}\left(u-\sqrt{\frac{2GM_e}{3R}}\right)^2$

Answer: (B) $5M\left(u^2-\frac{119}{200}\frac{GM_e}{R}\right)$ · Key from source paper

Q156 JEE Main 2020 · 7 Jan · Shift 2 MCQ

A box weighs $196\mathrm{N}$ on a spring balance at the north pole. Its weight recorded on the same balance if it is shifted to the equator is close to (Take $\mathrm{g}=10\mathrm{ms}^{-2}$ at the north pole and the radius of the earth $=6400\mathrm{km}$):

(A) $195.66\mathrm{N}$
(B) $194.32\mathrm{N}$
(C) $194.66\mathrm{N}$
(D) $195.32\mathrm{N}$

Answer: (D) $195.32\mathrm{N}$ · Key from source paper

Q157 JEE Main 2019 · 12 Apr · Shift 2 MCQ

The ratio of the weights of a body on Earth's surface to that on the surface of a planet is 9 : 4 The mass of the planet is $\frac{1}{9}th$ of that of the Earth. If R is the radius of the Earth, what is the radius of the planet? (Take the planets to have the same mass density)

(A) $\frac{R}{4}$
(B) $\frac{R}{2}$
(C) $\frac{R}{3}$
(D) $\frac{R}{9}$

Answer: (B) $\frac{R}{2}$ · Key from source paper

Q158 JEE Main 2019 · 10 Apr · Shift 1 MCQ

The value of acceleration due to gravity at Earth's surface is $9.8\ \mathrm{m\ s^{-2}}$. The altitude above its surface at which the acceleration due to gravity decreases to $4.9\ \mathrm{m\ s^{-2}}$, is close to: (Radius of earth $=6.4\times10^6\ \mathrm{m}$)

(A) $1.6\times10^6\ \mathrm{m}$
(B) $2.6\times10^6\ \mathrm{m}$
(C) $6.4\times10^6\ \mathrm{m}$
(D) $9.0\times10^6\ \mathrm{m}$

Answer: (B) $2.6\times10^6\ \mathrm{m}$ · Key from source paper

Q159 JEE Main 2019 · 10 Apr · Shift 2 MCQ

A spaceship orbits around a planet at a height of $20\ \mathrm{km}$ from its surface. Assuming that only gravitational field of the planet acts on the spaceship, what will be the number of complete revolutions made by the spaceship in 24 hours around the planet?
[Given: Mass of planet $= 8 \times 10^{22}\ \mathrm{kg}$,
Radius of planet $= 2 \times 10^{6}\ \mathrm{m}$,
Gravitational constant $G = 6.67 \times 10^{-11}\ \mathrm{Nm^2\ /\ kg^2}$]

(A) 17
(B) 9
(C) 13
(D) 11

Answer: (D) 11 · Key from source paper

Q160 JEE Main 2019 · 9 Apr · Shift 1 MCQ

A solid sphere of mass M and radius a is surrounded by a uniform concentric spherical shell of thickness 2a and mass 2M. The gravitational field at distance 3a from the centre will be:

(A) $\frac{GM}{9a^2}$
(B) $\frac{GM}{3a^2}$
(C) $\frac{2GM}{3a^2}$
(D) $\frac{2GM}{9a^2}$

Answer: (B) $\frac{GM}{3a^2}$ · Key from source paper

Q161 JEE Main 2019 · 9 Apr · Shift 2 MCQ

A test particle is moving in a circular orbit in the gravitational field produced by a mass density $\rho(r) = \frac{K}{r^2}$. Identify the current relation between the radius R of the particle's orbit and its period T :

(A) TR is a constant
(B) T^2/R^3 is a constant
(C) T/R is a constant
(D) T/R^2 is a constant

Answer: (C) T/R **is a constant** · Key from source paper

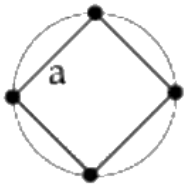
Q162 JEE Main 2019 · 8 Apr · Shift 1 MCQ

Four identical particles of mass M are located at the corners of a square of side 'a'. What should be their speed if each of them revolves under the influence of other's gravitational field in a circular orbit

circumscribing the square?

(see the figure above)

Q7. Four identical particles of mass M are located at the corners of a square of side 'a' . What should be their speed if each of them revolves under the influence of other's gravitational field in a circular orbit circumscribing the square?



(1) $1.35\sqrt{\frac{GM}{a}}$ (2) $1.21\sqrt{\frac{GM}{a}}$ (3) $1.41\sqrt{\frac{GM}{a}}$ (4) $1.16\sqrt{\frac{GM}{a}}$

(A) $1.35\sqrt{\frac{GM}{a}}$

(B) $1.21\sqrt{\frac{GM}{a}}$

(C) $1.41\sqrt{\frac{GM}{a}}$

(D) $1.16\sqrt{\frac{GM}{a}}$

Answer: (D) $1.16\sqrt{\frac{GM}{a}}$ · Key from source paper

Q163 JEE Main 2019 · 8 Apr · Shift 2 MCQ

A rocket has to be launched from earth in such a way that it never returns. If E is the minimum energy delivered by the rocket launcher, what should be the minimum energy that the launcher should have, if the same rocket is to be launched from the surface of the moon? Assume that the density of the earth and the moon are equal and that the earth's volume is 64 times the volume of the moon.

(A) $\frac{E}{64}$

(B) $\frac{E}{4}$

(C) $\frac{E}{32}$

(D) $\frac{E}{16}$

Answer: (D) $\frac{E}{16}$ · Key from source paper

Q164 JEE Main 2019 · 12 Jan · Shift 1 MCQ

A satellite of mass M is in a circular orbit of radius R about the center of the earth. A meteorite of the same mass, falling towards the earth, collides with the satellite completely inelastic. The speeds of the satellite and the meteorite are the same, just before the collision. The subsequent motion of the combined body will be:

(A) In an elliptical orbit
(B) Such that it escapes to infinity
(C) In a circular orbit of a different radius
(D) In the same circular orbit of radius R

Answer: (A) In an elliptical orbit · Key from source paper

Q165 JEE Main 2019 · 12 Jan · Shift 1 MCQ

A straight rod of length L extends from $x = a$ to $x = L + a$. The gravitational force it exerts on a point mass 'm' at $x = 0$, if the mass per unit length of the rod is $A + Bx^2$, is given by:

(A) $Gm\left[A\left(\frac{1}{a+L} - \frac{1}{a}\right) + BL\right]$
(B) $Gm\left[A\left(\frac{1}{a+L} - \frac{1}{a}\right) - BL\right]$
(C) $Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) - BL\right]$
(D) $Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) + BL\right]$

Answer: (D) $Gm\left[A\left(\frac{1}{a} - \frac{1}{a+L}\right) + BL\right]$ · Key from source paper

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Q166 JEE Main 2019 · 12 Jan · Shift 2 MCQ

Two satellites, A and B, have masses m and $2m$ respectively. A is in a circular orbit of radius R and B is in a circular orbit of radius $2R$ around the earth. The ratio of their kinetic energies, $\frac{K_A}{K_B}$ is:

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

Answer: (C) 1 · Key from source paper

Q167 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A satellite is revolving in a circular orbit at a height h from the carth surface, such that h << R where R is the radius of the earth. Assuming that the effect of earth"s atmosphere can be neglected the minimum increase in the speed required so that the satellite could escape from the gravitational field of earth is

(A) $\sqrt{2gR}$
(B) $\sqrt{gR}$
(C) $\sqrt{\frac{gR}{2}}$
(D) $\sqrt{gR}(\sqrt{2} - 1)$

Answer: (D) $\sqrt{gR}(\sqrt{2} - 1)$ · Key from source paper

Q168 JEE Main 2019 · 11 Jan · Shift 2 MCQ

The mass and the diameter of a planet are three times the respective values for the Earth. The period of oscillation of a simple pendulum on the Earth is 2 s. The period of oscillation of the same pendulum on the planet would be:

(A) $\frac{\sqrt{3}}{2}$ s
(B) $\frac{2}{\sqrt{3}}$ s
(C) $\frac{3}{2}$ s
(D) $2\sqrt{3}$ s

Answer: (D) $2\sqrt{3}$ s · Key from source paper

Q169 JEE Main 2019 · 10 Jan · Shift 1 MCQ

A satellite is moving with a constant speed v in circular orbit around the earth. An object of mass 'm' is ejected from the satellite such that it just escapes from the gravitational pull of the earth. At the time of ejection, the kinetic energy of the object is:

(A) $\frac{3}{2}m\,v^2$
(B) $m\,v^2$
(C) $\frac{1}{2}m\,v^2$
(D) $2\,m\,v^2$

Answer: (B) $m\,v^2$ · Key from source paper

Q170 JEE Main 2019 · 10 Jan · Shift 2 MCQ

Two stars of masses $3\times10^{31}\ \text{kg}$ each, and at distance $2\times10^{11}\ \text{m}$ rotate in a plane about their common centre of mass O. A meteorite passes through O moving perpendicular to the stars' rotation plane. In order to escape from the gravitational field of this double star, the minimum speed that meteorite should have at O is (Take Gravitational constant $G = 6.67\times10^{-11}\ \text{N}\,\text{m}^2\,\text{kg}^{-2}$)

(A) $2.4\times10^{4}\ \text{m}\,\text{s}^{-1}$
(B) $3.8\times10^{4}\ \text{m}\,\text{s}^{-1}$
(C) $2.8\times10^{5}\ \text{m}\,\text{s}^{-1}$
(D) $1.4\times10^{5}\ \text{m}\,\text{s}^{-1}$

Answer: (C) $2.8\times10^{5}\ \text{m}\,\text{s}^{-1}$ · Key from source paper

Q171 JEE Main 2019 · 9 Jan · Shift 1 MCQ

If the angular momentum of a planet of mass m, moving around the Sun in a circular orbit is L, about the center of the Sun, its areal velocity is:

(A) $\frac{L}{m}$
(B) $\frac{4L}{m}$
(C) $\frac{L}{2m}$
(D) $\frac{2L}{m}$

Answer: (C) $\frac{L}{2m}$ · Key from source paper

Q172 JEE Main 2019 · 9 Jan · Shift 2 MCQ

The energy required to take a satellite to a height h above the Earth surface (radius of Earth $= 6.4 \times 10^3$ km) is E_1, and the kinetic energy required for the satellite to be in a circular orbit at this height is E_2. The value of h for which E_1 and E_2 are equal, is

(A) $1.28 \times 10^4\, km$
(B) $6.4 \times 10^3\, km$
(C) $3.2 \times 10^3\, km$
(D) $1.6 \times 10^3\, km$

Answer: (C) $3.2 \times 10^3\, km$ · Key from source paper

Q173 JEE Main 2018 · 16 Apr · Online MCQ

The relative uncertainty in the period of a satellite orbiting around the earth is 10^{-2}. If the relative uncertainty in the radius of the orbit is negligible, the relative uncertainty in the mass of the earth is:

(A) 2×10^{-2}
(B) 6×10^{-2}
(C) 3×10^{-2}
(D) 10^{-2}

Answer: (A) 2×10^{-2} · Key from source paper

Q174 JEE Main 2018 · 16 Apr · Online MCQ

Suppose that the angular velocity of rotation of the Earth is increased. Then, as a consequence,

(A) weight of the object, everywhere on the earth, will decrease.
(B) weight of the object, everywhere on the earth, will increase.
(C) except at poles, weight of the object on the earth, will decrease.
(D) there will be no change in weight anywhere on the earth.

Answer: (C) except at poles, weight of the object on the earth, will decrease. · Key from source paper

EdLoop JEE

Q175 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A body of mass m is moving in a circular orbit of radius R about a planet of mass M. At some instant, it splits into two equal masses. The first mass moves in a circular orbit of radius $\frac{R}{2}$, and the other mass, in a circular orbit of radius $\frac{3R}{2}$. The difference between the final and initial total energies is:

(A) $-\frac{GMm}{2R}$
(B) $+\frac{GMm}{6R}$
(C) $-\frac{GMm}{6R}$
(D) $\frac{GMm}{2R}$

Answer: (C) $-\frac{GMm}{6R}$ · Key from source paper

Q176 JEE Main 2018 · 15 Apr · Shift 1 MCQ

Take the mean distance of the moon and the sun from the earth to be 0.4×10^6 km and 150×10^6 km respectively. Their masses are 8×10^{22} kg and 2×10^{30} kg respectively. The radius of the earth is 6400 km. Let ΔF_1 be the difference in the forces exerted by the moon at the nearest and farthest points on the earth and ΔF_2 be the difference in the force exerted by the sun at the nearest and farthest points on the earth. Then, the number closest to $\frac{\Delta F_1}{\Delta F_2}$ is:

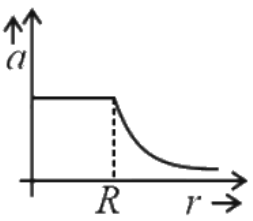
(A) 2
(B) 6
(C) 10^{-2}
(D) 0.6

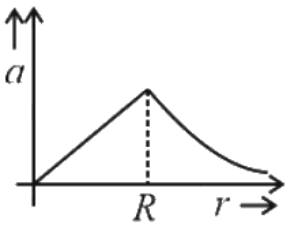
Answer: (A) 2 · Key from source paper

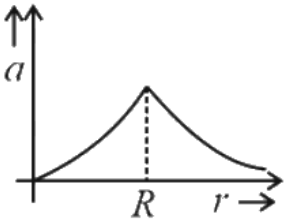
Q177 JEE Main 2017 · 9 Apr · Online MCQ

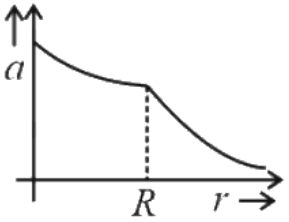
The mass density of a spherical body is given by $\rho(r) = \frac{k}{r}$ for $r \leq R$ and $\rho(r) = 0$ for $r > R$, where r is the distance from the center. The correct graph that describes qualitatively the acceleration, a of a test particle as a function of r is:

Q7. The mass density of a spherical body is given by $\rho(r) = \frac{k}{r}$ for $r \leq R$ and $\rho(r) = 0$ for $r > R$, where r is the distance from the center. The correct graph that describes qualitatively the acceleration, a of a test particle as a function of r is:

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q178 JEE Main 2017 · 8 Apr · Online MCQ

If the Earth has no rotational motion, the weight of a person on the equator is W. Determine the speed with which the earth would have to rotate about its axis so that the person at the equator will weigh $\frac{3}{4}W$. The radius of the Earth is 6400 km and $g = 10\ \text{m s}^{-2}$.

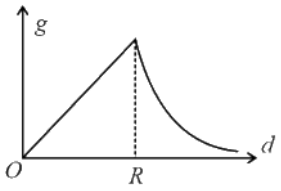
(A) $0.63 \times 10^{-3}\ \text{rad s}^{-1}$
(B) $0.28 \times 10^{-3}\ \text{rad s}^{-1}$
(C) $1.1 \times 10^{-3}\ \text{rad s}^{-1}$
(D) $0.83 \times 10^{-3}\ \text{rad s}^{-1}$

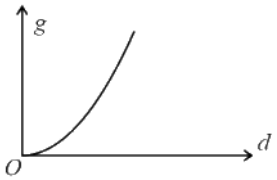
Answer: (A) $0.63 \times 10^{-3}\ \text{rad s}^{-1}$ · Key from source paper

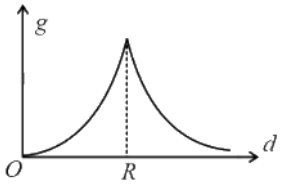
Q179 JEE Main 2017 · 2 Apr · Offline MCQ

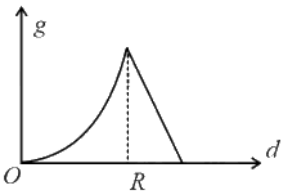
The variation of acceleration due to gravity g with distance d from the centre of the earth is best represented by (R= Earth's radius):

Q7. The variation of acceleration due to gravity g with distance d from the centre of the earth is best represented by (R= Earth's radius):

(1) 

(2) 

(3) 

(4) 

(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (A) · Key from source paper

Q180 JEE Main 2016 · 10 Apr · Online MCQ

An astronaut of mass m is working on a satellite orbiting the earth at a distance h from the earth's surface. The radius of the earth is R, while its mass is M. The gravitational pull F_G on the astronaut is

(A) Zero since astronaut feels weightless

(B) $\frac{GMm}{(R+h)^2} < F_G < \frac{GMm}{R^2}$

(C) $F_G = \frac{GMm}{(R+h)^2}$

(D) $0 < F_G < \frac{GMm}{R^2}$

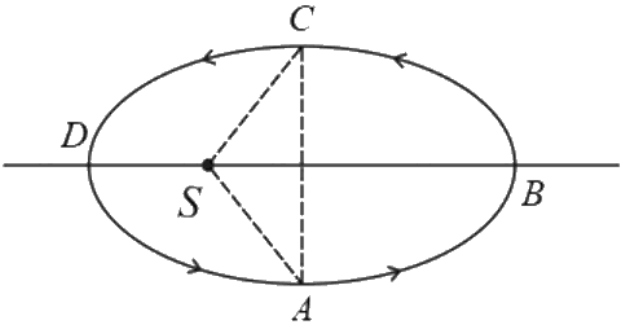
Answer: (C) $F_G = \frac{GMm}{(R+h)^2}$ · Key from source paper

Q181 JEE Main 2016 · 9 Apr · Online MCQ

The figure shows an elliptical path $ABCD$ of a planet around the sun S such that the area of triangle CSA is $\frac{1}{4}$ the area of the ellipse. (see figure) with DB as the major axis, and CA as the minor axis. If t_1 is the time taken for the planet to go over path ABC and t_2 for path taken over CDA then:

(see the figure above)

Q6. The figure shows an elliptical path $ABCD$ of a planet around the sun S such that the area of triangle CSA is $\frac{1}{4}$ the area of the ellipse. (see figure) with DB as the major axis, and CA as the minor axis. If t_1 is the time taken for the planet to go over path ABC and t_2 for path taken over CDA then:



(1) $t_1 = 4t_2$
(2) $t_1 = 2t_2$
(3) $t_1 = 3t_2$
(4) $t_1 = t_2$

(A) $t_1 = 4t_2$
(B) $t_1 = 2t_2$
(C) $t_1 = 3t_2$
(D) $t_1 = t_2$

Answer: (C) $t_1 = 3t_2$ · Key from source paper

Q182 JEE Main 2016 · 3 Apr · Offline MCQ

A satellite is revolving in a circular orbit at a height h from the earth's surface (radius of earth R; $h \ll R$). The minimum increase in its orbital velocity required, so that the satellite could escape from the earth's gravitational field, is close to (Neglect the effect of atmosphere.)

(A) $\sqrt{\frac{gR}{2}}$
(B) $\sqrt{gR}\left(\sqrt{2}-1\right)$
(C) $\sqrt{2\,gR}$
(D) $\sqrt{gR}$

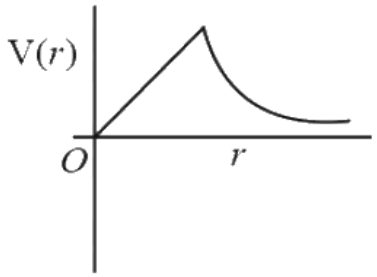
Answer: (B) $\sqrt{gR}\left(\sqrt{2}-1\right)$ · Key from source paper

Q183 JEE Main 2015 · 11 Apr · Online MCQ

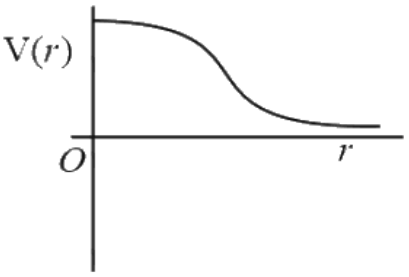
Which of the following most closely depicts the correct variation of the gravitation potential, $V(r)$ with distance r due to a large planet of radius R and uniform mass density? (figures are not drawn to scale)

Q9. Which of the following most closely depicts the correct variation of the gravitation potential, $V(r)$ with distance r due to a large planet of radius R and uniform mass density? (figures are not drawn to scale)

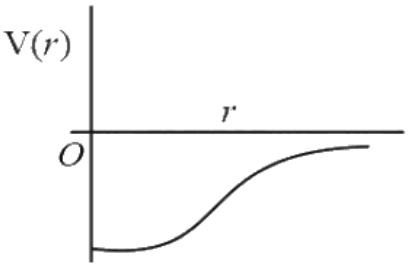
(1)



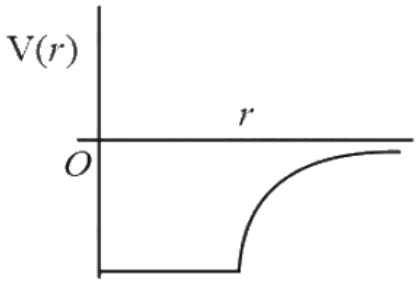
(2)



(3)



(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (C) · Key from source paper

Q184 JEE Main 2015 · 10 Apr · Online MCQ

A very long (length L) cylindrical galaxy is made of uniformly distributed mass and has radius R ($R << L$). A star outside the galaxy is orbiting the galaxy in a plane perpendicular to the galaxy and passing through its centre. If the time period of the star is T and its distance from the galaxy's axis is r, then

(A) $T \propto \sqrt{r}$

(B) $T \propto r$

(C) $T \propto r^2$

(D) $T^2 \propto r^3$

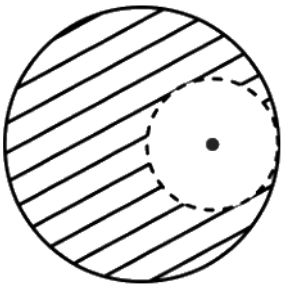
Answer: (B) $T \propto r$ · Key from source paper

Q185 JEE Main 2015 · 4 Apr · Offline MCQ

From a solid sphere of mass M and radius R, a spherical portion of radius $\left(\frac{R}{2}\right)$ is removed as shown in the figure. Taking gravitational potential $V = 0$ at $r = \infty$, the potential at the centre of the cavity thus formed is (G =gravitational constant)

(see the figure above)

Q7. From a solid sphere of mass M and radius R, a spherical portion of radius $\left(\frac{R}{2}\right)$ is removed as shown in the figure. Taking gravitational potential $V = 0$ at $r = \infty$, the potential at the centre of the cavity thus formed is (G =gravitational constant)



(1) $\frac{-2GM}{R}$
(2) $\frac{-GM}{2R}$
(3) $\frac{-GM}{R}$
(4) $\frac{-2GM}{3R}$

(A) $\frac{-2GM}{R}$
(B) $\frac{-GM}{2R}$
(C) $\frac{-GM}{R}$
(D) $\frac{-2GM}{3R}$

Answer: (C) $\frac{-GM}{R}$ · Key from source paper

Q186 JEE Main 2014 · 19 Apr · Online MCQ

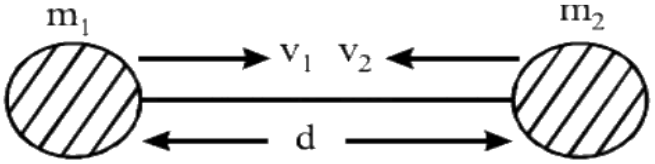
The gravitational field in a region is given by $\vec{g} = \left(5\hat{i} + 12\hat{j}\right)\ \mathrm{N\,kg^{-1}}$. The change in the gravitational potential energy of a particle of mass $2\ \mathrm{kg}$ when it is taken from the origin to a point $(7\ \mathrm{m}, -3\ \mathrm{m})$ is

(A) $71\ \mathrm{J}$
(B) $13\sqrt{58}\ \mathrm{J}$
(C) $2\ \mathrm{J}$
(D) $1\ \mathrm{J}$

Answer: (C) $2\ \mathrm{J}$ · Key from source paper

Q187 JEE Main 2014 · 12 Apr · Online MCQ

see figure

Q7. 

Two hypothetical planets of masses m_1 and m_2 are at rest when they are infinite distance apart. Because of the gravitational force they move towards each other along the line joining their centres. What is their speed when their separation is ' d '? (Speed of m_1 is v_1 and that of m_2 is v_2)

(1) $v_1 = v_2$

(2) $v_1 = m_2\sqrt{\frac{2G}{d(m_1+m_2)}}$, $v_2 = m_1\sqrt{\frac{2G}{d(m_1+m_2)}}$

(3) $v_1 = m_1\sqrt{\frac{2G}{d(m_1+m_2)}}$, $v_2 = m_2\sqrt{\frac{2G}{d(m_1+m_2)}}$

(4) $v_1 = m_2\sqrt{\frac{2G}{m_1}}$, $v_2 = m_2\sqrt{\frac{2G}{m_2}}$

(A) $v_1 = v_2$

(B) $v_1 = m_2\sqrt{\frac{2G}{d(m_1+m_2)}}$; $v_2 = m_1\sqrt{\frac{2G}{d(m_1+m_2)}}$

(C) $v_1 = m_1\sqrt{\frac{2G}{d(m_1+m_2)}}$; $v_2 = m_2\sqrt{\frac{2G}{d(m_1+m_2)}}$

(D) $v_1 = m_2\sqrt{\frac{2G}{m_1}}$; $v_2 = m_2\sqrt{\frac{2G}{m_2}}$

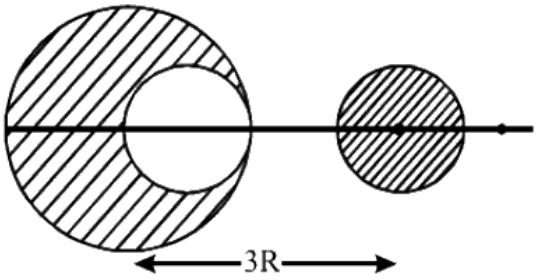
Answer: (B) $v_1 = m_2\sqrt{\frac{2G}{d(m_1+m_2)}}$; $v_2 = m_1\sqrt{\frac{2G}{d(m_1+m_2)}}$ · Key from source paper

Q188 JEE Main 2014 · 11 Apr · Online MCQ

From a sphere of mass M and radius R, a smaller sphere of radius $\frac{R}{2}$ is carved out such that the cavity made in the original sphere is between its centre and the periphery (See figure). For the configuration in the figure where the distance between the centre of the original sphere and the removed sphere is 3R, the gravitational force between the two sphere is:

(see the figure above)

Q6. From a sphere of mass M and radius R, a smaller sphere of radius $\frac{R}{2}$ is carved out such that the cavity made in the original sphere is between its centre and the periphery (See figure). For the configuration in the figure where the distance between the centre of the original sphere and the removed sphere is 3R, the gravitational force



between the two sphere is:

(1) $\frac{41GM^2}{3600R^2}$
(2) $\frac{41GM^2}{450R^2}$
(3) $\frac{59GM^2}{450R^2}$
(4) $\frac{GM^2}{225R^2}$

(A) $\frac{41GM^2}{3600R^2}$
(B) $\frac{41GM^2}{450R^2}$
(C) $\frac{59GM^2}{450R^2}$
(D) $\frac{GM^2}{225R^2}$

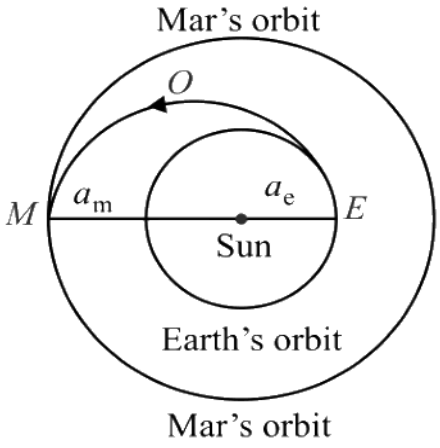
Answer: (A) $\frac{41GM^2}{3600R^2}$ · Key from source paper

Q189 JEE Main 2014 · 9 Apr · Online MCQ

India's Mangalyan was sent to the Mars by launching it into a transfer orbit EOM around the sun. It leaves the earth at E and meets Mars at M. If the semi-major axis of Earth's orbit is $a_e = 1.5 \times 10^{11}$ m , that of Mar's orbit $a_m = 2.28 \times 10^{11}$m, taking Kepler's laws, give the estimate of time for Mangalyan to reach Mars from Earth.

(see the figure above)

Q6. India's Mangalyan was sent to the Mars by launching it into a transfer orbit EOM around the sun. It leaves the earth at E and meets Mars at M. If the semi-major axis of Earth's orbit is $a_e = 1.5 \times 10^{11}$m , that of Mar's orbit $a_m = 2.28 \times 10^{11}$m, taking Kepler's laws, give the estimate of time for Mangalyan to reach Mars from Earth.



(1) 220 days.
(2) 500 days.
(3) 260 days.
(4) 320 days.

(A) 220 days.
(B) 500 days.
(C) 260 days.
(D) 320 days.

Answer: (C) 260 days. · Key from source paper

Q190 JEE Main 2014 · 6 Apr · Offline MCQ

Four particles, each of mass M and equidistant from each other, move along a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

(A) $\sqrt{\frac{GM}{R}}$
(B) $\sqrt{2\sqrt{2}\frac{GM}{R}}$
(C) $\sqrt{\frac{GM}{R}\left(1+2\sqrt{2}\right)}$
(D) $\frac{1}{2}\sqrt{\frac{GM}{R}\left(1+2\sqrt{2}\right)}$

Answer: (D) $\frac{1}{2}\sqrt{\frac{GM}{R}\left(1+2\sqrt{2}\right)}$ · Key from source paper

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Q191 JEE Main 2013 · 25 Apr · Online MCQ

The gravitational field in a region is given by: $E = (5\,\mathrm{N/kg})\hat{i} + (12\,\mathrm{N/kg})\hat{j}$ If the potential at the origin is taken to be zero, then the ratio of the potential at the points $(12\ \mathrm{m}, 0)$ and $(0, 5\ \mathrm{m})$ is :

(A) Zero
(B) 1
(C) $\frac{144}{25}$
(D) $\frac{25}{144}$

Answer: (B) 1 · Key from source paper

Q192 JEE Main 2013 · 22 Apr · Online MCQ

The change in the value of acceleration of earth towards sun, when the moon comes from the position of solar eclipse to the position on the other side of earth in line with sun is: (mass of the moon $= 7.36 \times 10^{22}$ kg, radius of the moon's orbit $= 3.8 \times 10^{8}$ m).

(A) $6.73 \times 10^{-5}\ \mathrm{m/s^2}$
(B) $6.73 \times 10^{-3}\ \mathrm{m/s^2}$
(C) $6.73 \times 10^{-2}\ \mathrm{m/s^2}$
(D) $6.73 \times 10^{-4}\ \mathrm{m/s^2}$

Answer: (A) $6.73 \times 10^{-5}\ \mathrm{m/s^2}$ · Key from source paper

Q193 JEE Main 2013 · 9 Apr · Online · MCQ

The gravitational field, due to the 'left over part' of a uniform sphere (from which a part as shown, has been 'removed out'), at a very far off point, P, located as shown, would be (nearly) :

(A) $\frac{5}{6}\frac{GM}{x^2}$
(B) $\frac{8}{9}\frac{GM}{x^2}$
(C) $\frac{7}{8}\frac{GM}{x^2}$
(D) $\frac{6}{7}\frac{GM}{x^2}$

Answer: (C) $\frac{7}{8}\frac{GM}{x^2}$ · Key from source paper

Q194 JEE Main 2013 · 7 Apr · Offline · MCQ

What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of 2R?

(A) $\frac{GmM}{2R}$
(B) $\frac{GmM}{3R}$
(C) $\frac{5GmM}{6R}$
(D) $\frac{2GmM}{3R}$

Answer: (C) $\frac{5GmM}{6R}$ · Key from source paper

Q195 AIEEE 2012 · 26 May · Online · MCQ

A point particle is held on the axis of a ring of mass m and radius r at a distance r from its centre C. When released, it reaches C under the gravitational attraction of the ring. Its speed at C will be

(A) $\sqrt{\frac{2Gm}{r}(\sqrt{2}-1)}$
(B) $\sqrt{\frac{Gm}{r}}$
(C) $\sqrt{\frac{2Gm}{r}\left(1-\frac{1}{\sqrt{2}}\right)}$
(D) $\sqrt{\frac{2Gm}{r}}$

Answer: (C) $\sqrt{\frac{2Gm}{r}\left(1-\frac{1}{\sqrt{2}}\right)}$ · Key from source paper

Q196 AIEEE 2012 · 19 May · Online · MCQ

Two point masses of mass $m_1 = fM$ and $m_2 = (1-f)M (f < 1)$ are in outer space (far from gravitational influence of other objects) at a distance R from each other. They move in circular orbits about their centre of mass with angular velocities ω_1 for m_1 and ω_2 for m_2. In that case

(A) $(1-f)\omega_1 = f\omega$

(B) $\omega_1 = \omega_2$ and independent of f

(C) $f\omega_1 = (1-f)\omega_2$

(D) $\omega_1 = \omega_2$ and depend on f

Answer: (B) $\omega_1 = \omega_2$ and independent of f · Key from source paper

Q197 AIEEE 2012 · 12 May · Online MCQ

Assuming the earth to be a sphere of uniform density, the acceleration due to gravity inside the earth at a distance of r from the centre is proportional to

(A) r

(B) r^{-1}

(C) r^2

(D) r^{-2}

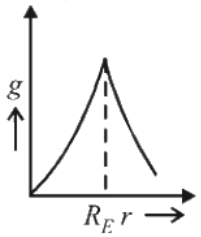
Answer: (A) r · Key from source paper

Q198 AIEEE 2012 · 7 May · Online MCQ

Which graph correctly presents the variation of acceleration due to gravity with the distance from the centre of the earth (radius of the earth = R_E)?

Q8. Which graph correctly presents the variation of acceleration due to gravity with the distance from the centre of the earth (radius of the earth = R_E)?

(1)



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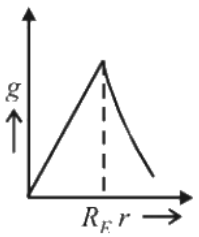

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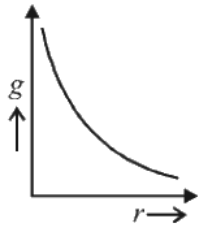
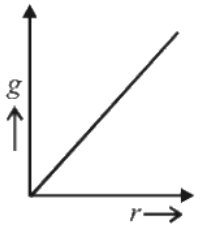


(4)



(A) *see figure*

(B) *see figure*

(C) *see figure*

(D) *see figure*

Answer: (B) · Key from source paper

Q199 AIEEE 2012 · Offline MCQ

The mass of a spaceship is $1000\ \mathrm{kg}$. It is to be launched from the earth's surface out into free space. The value of ' g ' and ' R ' (radius of earth) are $10\ \mathrm{m/s^2}$ and $6400\ \mathrm{km}$ respectively. The required energy for this work will be ;

(A) 6.4×10^{11} Joules
(B) 6.4×10^{8} Joules
(C) 6.4×10^{9} Joules
(D) 6.4×10^{10} Joules

Answer: (D) 6.4×10^{10} **Joules** · Key from source paper

Q200 AIEEE 2011 MCQ

Two bodies of masses m and 4 m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is:

(A) $-\frac{4Gm}{r}$
(B) $-\frac{6Gm}{r}$
(C) $-\frac{9Gm}{r}$
(D) zero

Answer: (C) $-\frac{9Gm}{r}$ · Key from source paper

Q201 AIEEE 2009 MCQ

The height at which the acceleration due to gravity becomes $\frac{g}{9}$ (where g = the acceleration due to gravity on the surface of the earth) in terms of R, the radius of the earth is

(A) $2R$
(B) $\frac{R}{\sqrt{2}}$
(C) $\frac{R}{2}$
(D) $\sqrt{2}\mathrm{R}$

Answer: (A) $2R$ · Key from source paper

Q202 AIEEE 2008 MCQ

A planet in a distant solar system is 10 times more massive than the earth and its radius is 10 times smaller. Given that the escape velocity from the earth is $11\ \mathrm{kms^{-1}}$, the escape velocity from the surface of the planet would be

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(A) $1.1\ \mathrm{kms}^{-1}$
(B) $11\ \mathrm{kms}^{-1}$
(C) $110\ \mathrm{kms}^{-1}$
(D) $0.11\ \mathrm{kms}^{-1}$

Answer: (C) $110\ \mathrm{kms}^{-1}$ · Key from source paper

Q203 AIEEE 2008 MCQ

This question contains Statement -1 and Statement-2. Of the four choices given after the statements, choose the one that best describes the two statements. Statement - I: For a mass M kept at the centre of a cube of side ' a ', the flux of gravitational field passing through its sides is 4π GM. and Statement - II If the direction of a field due to a point source is radial and its dependence on the distance ' r ' for the source is given as $1/r^2$, its flux through a closed surface depends only on the strength of the source enclosed by the surface and not on the size or shape of the surface

(A) Statement -1 is false, Statement -2 is true.
(B) Statement -1 is true, Statement -2 is true; Statement -2 is correct explanation for Statement-1.
(C) Statement -1 is true, Statement -2 is true; Statement -2 is not a correct explanation for Statement-1.
(D) Statement -1 is true, Statement -2 is False.

Answer: (B) Statement -1 is true, Statement -2 is true; Statement -2 is correct explanation for Statement-1. · Key from source paper

Q204 AIEEE 2005 MCQ

Average density of the earth

(A) does not depend on g
(B) is a complex function of g
(C) is directly proportional to g
(D) is inversely proportional to g

Answer: (C) is directly proportional to g · Key from source paper

Q205 AIEEE 2005 MCQ

The change in the value of g at a height ' h ' above the surface of the earth is the same as at a depth 'd' below the surface of earth. When both ' d ' and ' h ' are much smaller than the radius of earth, then which one of the following is correct?

(A) $d = \frac{h}{2}$
(B) $\mathrm{d} = \frac{3\,\mathrm{h}}{2}$
(C) $\mathrm{d} = 2\,\mathrm{h}$
(D) $\mathrm{d} = \mathrm{h}$

Answer: (C) $\mathrm{d} = 2\,\mathrm{h}$ · Key from source paper

Q206 AIEEE 2005 MCQ

A particle of mass 10 g is kept on the surface of a uniform sphere of mass 100 kg and radius 10 cm. Find the work to be done against the gravitational force between them to take the particle far away from the sphere (you may take $\mathrm{G} = 6.67 \times 10^{-11}\,\mathrm{Nm^2/kg^2}$)

(A) $13.34 \times 10^{-10}\ \mathrm{J}$
(B) $3.33 \times 10^{-10}\ \mathrm{J}$
(C) $6.67 \times 10^{-9}\ \mathrm{J}$
(D) $6.67 \times 10^{-10}\ \mathrm{J}$

Answer: (D) $6.67 \times 10^{-10}\ \mathrm{J}$ · Key from source paper

Q207 AIEEE 2004 MCQ

A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is

(A) gx
(B) $\frac{\mathrm{gR}}{\mathrm{R-x}}$
(C) $\frac{g^2}{R+x}$
(D) $\left(\frac{gR^2}{R+x}\right)^{1/2}$

Answer: (D) $\left(\frac{gR^2}{R+x}\right)^{1/2}$ · Key from source paper

Q208 AIEEE 2004 MCQ

The time period of an earth satellite in circular orbit is independent of

(A) the mass of the satellite
(B) radius of its orbit
(C) both the mass and radius of the orbit
(D) neither the mass of the satellite nor the radius of its orbit.

Answer: (A) the mass of the satellite · Key from source paper

Q209 AIEEE 2004 MCQ

If g is the acceleration due to gravity on the earth's surface, the gain in the potential energy of object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is

(A) 2mgR
(B) $\frac{1}{2}$mgR
(C) $\frac{1}{4}$mgR
(D) mgR

Answer: (B) $\frac{1}{2}$mgR · Key from source paper

Q210 AIEEE 2004 MCQ

Suppose the gravitational force varies inversely as the nth power of distance. Then the time period planet in circular orbit of radius R around the sun will be proportional to

(A) $R^{\left(\frac{n+1}{2}\right)}$
(B) $R^{\left(\frac{n-1}{2}\right)}$
(C) R^{n}
(D) $\mathrm{R}^{\left(\frac{n-2}{2}\right)}$

Answer: (A) $R^{\left(\frac{n+1}{2}\right)}$ · Key from source paper

Q211 AIEEE 2003 MCQ

The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become

(A) 10 hours
(B) 80 hours
(C) 40 hours
(D) 20 hours

Answer: (C) 40 hours · Key from source paper

Q212 AIEEE 2003 MCQ

The escape velocity for a body projected vertically upwards from the surface of earth is 11 km/s. If the body is projected at an angle of 45° with the vertical, the escape velocity will be

(A) $11\sqrt{2}$ km/s
(B) 22 km/s
(C) 11 km/s
(D) $\frac{11}{\sqrt{2}}$ km/s

Answer: (C) 11 km/s · Key from source paper

Q213 AIEEE 2002 MCQ

The kinetic energy needed to project a body of mass m from the earth surface (radius R) to infinity is

(A) mgR/2
(B) 2mgR
(C) mgR
(D) mgR/4

Answer: (C) mgR · Key from source paper

Q214 AIEEE 2002 MCQ

Energy required to move a body of mass m from an orbit of radius 2R to 3R is

(A) $\mathrm{GMm/12R^2}$
(B) $\mathrm{GMm/3R^2}$
(C) $\mathrm{GMm/8R}$
(D) $\mathrm{GMm/6R}$

Answer: (D) $\mathrm{GMm/6R}$ · Key from source paper

Q215 AIEEE 2002 MCQ

The escape velocity of a body depends upon mass as

(A) m^0
(B) m^1
(C) m^2
(D) m^3

Answer: (A) m^0 · Key from source paper

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