CUET PG 2026 Geophysics Question Paper with Solutions(Memory Based)

Time Allowed :1 Hours 30 minutes	Maximum Marks :300	Total Questions :75

General Instructions

1. The exam lasts 90 minutes (1 hour 30 minutes).
2. There are 75 Multiple Choice Questions (MCQs) to be answered.
3. +4 marks for every correct answer. -1 mark (negative marking) for every incorrect answer. 0 marks for unanswered or un-attempted questions.
4. For any discrepancy in questions, the English version is considered final (except for language-specific papers).
5. Click one of the four options to choose an answer.
6. You must click "Save & Next" to confirm your response. Only saved answers are considered for evaluation.
7. Use "Mark for Review & Next" to flag a question for later. You can unselect or change your answer using the "Clear Response" button.
8. All calculations must be done on the Rough Sheets provided at the centre. These must be returned to the invigilator after the exam.

1. What is the shape of the air film formed in the Newton's ring experiment?
(A) Plane
(B) Cylindrical
(C) Spherical
(D) Wedge-shaped

Correct Answer: (D) Wedge-shaped

Solution:
Step 1: Understanding the Concept:
Newton's rings are an interference pattern caused by the reflection of light between two surfaces: a spherical surface and an adjacent flat surface.
Step 2: Detailed Explanation:
In the standard Newton's rings experiment, a plano-convex lens with a large radius of curvature is placed with its convex spherical surface on a flat glass plate.
This arrangement encloses a thin film of air between the lens and the glass plate.
The thickness of this air film is zero at the point of contact (the center) and gradually increases radially outwards.
Due to this continuously increasing thickness from the center towards the periphery, the air film effectively behaves as a wedge-shaped film in any given cross-section.
Step 3: Final Answer:
The shape of the air film formed is wedge-shaped.

Quick Tip

Even though the overall symmetry of the setup is circular (giving circular rings), the radial cross-section of the enclosed air film has a continuously varying thickness starting from zero, which defines a wedge shape.

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2. Which Maxwell's equation represents Gauss's Law in Magnetostatics?
(A) $\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$
(B) $\nabla \cdot \mathbf{B} = 0$
(C) $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$
(D) $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$

Correct Answer: (B) $\nabla \cdot \mathbf{B} = 0$

Solution:
Step 1: Understanding the Concept:
Maxwell's equations are a set of four fundamental equations governing classical electromagnetism.
Gauss's Law for Magnetism states that the net magnetic flux out of any closed surface is zero, which physically implies the non-existence of magnetic monopoles.
Step 2: Key Formula or Approach:
The integral form of Gauss's Law for magnetism is:

$$\oint \mathbf{B} \cdot d\mathbf{A} = 0$$

By applying the Divergence Theorem, this is converted into the differential form:

$$\nabla \cdot \mathbf{B} = 0$$

Step 3: Detailed Explanation:
Option (A) is Gauss's Law for Electrostatics ($\nabla \cdot \mathbf{E} = \rho/\varepsilon_0$).
Option (C) is Faraday's Law of Induction.
Option (D) is Ampere's Law (without Maxwell's displacement current addition).
Option (B) represents that magnetic field lines form continuous closed loops without any sources or sinks, establishing it as Gauss's Law in Magnetostatics.
Step 4: Final Answer:
The correct equation is $\nabla \cdot \mathbf{B} = 0$.

Quick Tip

"Divergence of $\mathbf{B}$ is zero" directly translates to "no isolated magnetic charges (monopoles) exist".

3. Calculate the efficiency of a Carnot engine operating between the steam point (373 K) and ice point (273 K).
(A) 26.8%
(B) 36.8%
(C) 46.8%
(D) 56.8%

Correct Answer: (A) 26.8%

Solution:
Step 1: Understanding the Concept:
A Carnot engine is an ideal, reversible thermodynamic cycle whose efficiency depends purely on the temperatures of the hot and cold thermal reservoirs.
Step 2: Key Formula or Approach:
The efficiency η of a Carnot engine is given by:

$$\eta = 1 - \frac{T_C}{T_H}$$

where T_C is the temperature of the cold reservoir and T_H is the temperature of the hot reservoir.
To express it as a percentage:

$$\eta(\%) = \left(1 - \frac{T_C}{T_H}\right) \times 100$$

Step 3: Detailed Explanation:
Given values are:
Hot reservoir temperature (steam point), $T_H = 373$ K.
Cold reservoir temperature (ice point), $T_C = 273$ K.
Substituting the values into the formula:

$$\eta = 1 - \frac{273}{373}$$

$$\eta = \frac{373 - 273}{373} = \frac{100}{373}$$

$$\eta \approx 0.26809$$

Converting to percentage:

$$\eta(\%) = 0.26809 \times 100 \approx 26.8\%$$

Step 4: Final Answer:

The efficiency of the Carnot engine is 26.8%.

Quick Tip

Always ensure the temperatures are in absolute units (Kelvin) before applying the Carnot efficiency formula. Using Celsius will lead to completely incorrect results.

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4. What is the Compton shift for a photon backscattered at 180 degrees?
(A) $\frac{h}{mc}$
(B) $\frac{2h}{mc}$
(C) $\frac{h}{2mc}$
(D) 0

Correct Answer: (B) $\frac{2h}{mc}$

Solution:
Step 1: Understanding the Concept:
Compton scattering refers to the inelastic scattering of a photon by a charged particle (usually an electron), which results in a decrease in the photon's energy and an increase in its wavelength.
The change in wavelength is known as the Compton shift.
Step 2: Key Formula or Approach:
The formula for the Compton shift ($\Delta\lambda$) is given by:

$$\Delta\lambda = \lambda' - \lambda = \frac{h}{mc}(1 - \cos\theta)$$

where h is Planck's constant, m is the rest mass of the electron, c is the speed of light, and θ is the scattering angle.
Step 3: Detailed Explanation:
The question states the photon is backscattered at 180°.
Substituting $\theta = 180°$ into the formula:

$$\cos(180°) = -1$$

$$\Delta\lambda = \frac{h}{mc}(1 - (-1))$$

$$\Delta\lambda = \frac{h}{mc}(1 + 1)$$

$$\Delta\lambda = \frac{2h}{mc}$$

Step 4: Final Answer:
The Compton shift for a photon backscattered at 180° is $\frac{2h}{mc}$, which is the maximum possible Compton shift.

> 💡 Quick Tip
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> Remember these key angles for Compton shift:
> - At 0° (forward scattering), $\Delta\lambda = 0$.
> - At 90° (orthogonal scattering), $\Delta\lambda = \frac{h}{mc}$ (known as the Compton wavelength).
> - At 180° (backscattering), $\Delta\lambda = \frac{2h}{mc}$ (Maximum shift).

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5. For a series LCR circuit, what is the formula for the phase angle between current and emf?
(A) $\tan\phi = \frac{X_L - X_C}{R}$
(B) $\tan\phi = \frac{R}{X_L - X_C}$
(C) $\sin\phi = \frac{X_L - X_C}{R}$
(D) $\cos\phi = \frac{X_L - X_C}{R}$

Correct Answer: (A) $\tan\phi = \frac{X_L - X_C}{R}$

Solution:
Step 1: Understanding the Concept:
In a series LCR (Inductor, Capacitor, Resistor) circuit, the alternating current (AC) experiences opposition to its flow, known as impedance (Z).
The voltage across the inductor (V_L) leads the current by 90°, the voltage across the capacitor (V_C) lags the current by 90°, and the voltage across the resistor (V_R) is in phase with the current.
Step 2: Key Formula or Approach:
Using a phasor diagram, the net reactive voltage is $V_L - V_C$ (assuming $X_L > X_C$), which lies on the y-axis, and the resistive voltage V_R lies on the x-axis.
The phase angle ϕ is the angle between the net applied emf and the current.
From the impedance triangle, we know:

$$\tan\phi = \frac{\text{Net Reactance}}{\text{Resistance}} = \frac{X_L - X_C}{R}$$

Step 3: Detailed Explanation:
Looking at the trigonometric relations derived from the impedance triangle:
- $\tan\phi = \frac{X_L - X_C}{R}$
- $\cos\phi = \frac{R}{Z}$ (Power Factor)
- $\sin\phi = \frac{X_L - X_C}{Z}$
Option (A) perfectly matches the standard relation for the tangent of the phase angle.
Step 4: Final Answer:

The correct formula is $\tan\phi = \frac{X_L - X_C}{R}$.

> 💡 Quick Tip
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> Drawing the impedance triangle mentally is the quickest way to verify this: base is R, perpendicular is $(X_L - X_C)$, and hypotenuse is Z. Therefore, $\tan\phi =$ Perpendicular/Base.

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6. According to Wien's displacement law, how is the surface temperature of a star related to its maximum intensity wavelength?
(A) $\lambda_{\text{max}} \propto T$
(B) $\lambda_{\text{max}} \propto \frac{1}{T}$
(C) $\lambda_{\text{max}} \propto T^2$
(D) $\lambda_{\text{max}} \propto \frac{1}{T^2}$

Correct Answer: (B) $\lambda_{\text{max}} \propto \frac{1}{T}$

Solution:
Step 1: Understanding the Concept:
Wien's displacement law is a principle of black-body radiation.
It states that the black-body radiation curve for different temperatures peaks at a specific wavelength, and this peak wavelength is inversely proportional to the absolute temperature of the body.
Step 2: Key Formula or Approach:
The mathematical formulation of Wien's displacement law is:

$$\lambda_{\text{max}} \cdot T = b$$

where λ_{max} is the wavelength at which the emission intensity is maximized, T is the absolute surface temperature (in Kelvin), and b is Wien's displacement constant ($\approx 2.898 \times 10^{-3}$ m $\cdot$ K).
Step 3: Detailed Explanation:
Rearranging the formula to isolate λ_{max}:

$$\lambda_{\text{max}} = \frac{b}{T}$$

This explicitly demonstrates an inverse relationship between the maximum intensity wavelength and the temperature.
Therefore, $\lambda_{\text{max}} \propto \frac{1}{T}$.
Step 4: Final Answer:
The surface temperature is related to the maximum intensity wavelength by $\lambda_{\text{max}} \propto \frac{1}{T}$.

Quick Tip

This law explains why hotter stars appear blue (shorter wavelengths) while cooler stars appear red (longer wavelengths). Higher T means smaller λ_{max}.

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7. Which thermodynamic process must occur "infinitesimally slowly" to remain reversible?
(A) Isothermal process
(B) Adiabatic process
(C) Quasi-static process
(D) Isochoric process

Correct Answer: (C) Quasi-static process

Solution:
Step 1: Understanding the Concept:
In thermodynamics, reversibility implies that a system can undergo a process and then perfectly return to its initial state without increasing the entropy of the universe.
For a process to be practically perfectly reversible, there must be no dissipating forces (like friction), and the system must remain in thermodynamic equilibrium throughout the transformation.
Step 2: Detailed Explanation:
To maintain thermodynamic equilibrium continuously, any change made to the system must happen at an infinitesimally slow rate.
This ensures that the intensive properties (like temperature and pressure) are uniform throughout the system at any given moment.
A process carried out under these extremely slow conditions is explicitly defined as a "quasi-static" process (quasi = almost, static = stationary).
While isothermal or adiabatic processes can be reversible under ideal conditions, the fundamental procedural requirement for ANY process to be reversible is that it must be quasi-static.
Step 3: Final Answer:
The process that must occur infinitesimally slowly to remain reversible is the quasi-static process.

Quick Tip

All perfectly reversible processes are quasi-static, but not all quasi-static processes are reversible (e.g., if friction is present even slowly, it's irreversible). However, "infinitesimally slowly" is the hallmark definition of "quasi-static" in multiple-choice exams.

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8. What is the relation between the polarizing angle and the refractive index in Brewster's Law?
(A) $\mu = \sin\theta_p$

(B) $\mu = \cos\theta_p$
(C) $\mu = \tan\theta_p$
(D) $\mu = \cot\theta_p$

Correct Answer: (C) $\mu = \tan\theta_p$

Solution:
Step 1: Understanding the Concept:
Brewster's Law gives the relationship between the angle of incidence at which light with a particular polarization is perfectly transmitted through a transparent dielectric surface, with no reflection.
For unpolarized incident light, the light reflected at this specific angle (called Brewster's angle or the polarizing angle, θ_p) is completely plane-polarized.
Step 2: Key Formula or Approach:
At the polarizing angle θ_p, the angle between the reflected ray and the refracted ray is exactly 90°.
From Snell's law:

$$\mu = \frac{\sin\theta_i}{\sin\theta_r}$$

Substituting $\theta_i = \theta_p$. Since the reflected and refracted rays are perpendicular, $\theta_p + 90^\circ + \theta_r = 180^\circ \implies \theta_r = 90^\circ - \theta_p$.
Step 3: Detailed Explanation:
Substitute θ_r into Snell's law:

$$\mu = \frac{\sin\theta_p}{\sin(90^\circ - \theta_p)}$$

Since $\sin(90^\circ - \theta_p) = \cos\theta_p$:

$$\mu = \frac{\sin\theta_p}{\cos\theta_p}$$

$$\mu = \tan\theta_p$$

Step 4: Final Answer:
The correct relation representing Brewster's Law is $\mu = \tan\theta_p$.

> Quick Tip
>
> At Brewster's angle, the reflected and refracted rays are always mutually perpendicular (90° apart). This specific geometric condition is highly tested alongside the main formula.

9. How does the orbital period of a satellite change as its distance from the Earth's center increases?
(A) $T \propto r$
(B) $T \propto r^2$
(C) $T \propto r^{3/2}$
(D) $T \propto \frac{1}{r}$

Correct Answer: (C) $T \propto r^{3/2}$

Solution:
Step 1: Understanding the Concept:
The motion of a satellite orbiting the Earth is governed by the gravitational force acting as the necessary centripetal force.
The relationship between the orbital period (T) and the orbital radius (r) is formulated in Kepler's Third Law of Planetary Motion, which applies to any satellite orbiting a central massive body.
Step 2: Key Formula or Approach:
Kepler's Third Law states that the square of the orbital period is directly proportional to the cube of the semi-major axis of its orbit. For a circular orbit of radius r, this is written as:

$$T^2 \propto r^3$$

Step 3: Detailed Explanation:
To find the direct proportionality of T with respect to r, we take the square root of both sides of Kepler's Third Law:

$$\sqrt{T^2} \propto \sqrt{r^3}$$

$$T \propto \left(r^3\right)^{1/2}$$

$$T \propto r^{3/2}$$

This shows that as the distance r from the Earth's center increases, the orbital period T increases non-linearly according to the 3/2 power law.
Step 4: Final Answer:
The correct relationship is $T \propto r^{3/2}$.

Quick Tip

You can rapidly derive Kepler's Third law by equating centripetal force to gravitational force: $\frac{mv^2}{r} = \frac{GMm}{r^2}$. Since $v = \frac{2\pi r}{T}$, substituting this yields $\frac{4\pi^2 r^2}{T^2 r} = \frac{GM}{r^2} \implies T^2 = \frac{4\pi^2}{GM} r^3$.

10. In a P-N junction diode, which terminal is connected to the P-side during forward biasing?
(A) Negative terminal
(B) Positive terminal
(C) Ground
(D) Neutral terminal

Correct Answer: (B) Positive terminal

Solution:
Step 1: Understanding the Concept:
A P-N junction diode operates essentially as a one-way valve for electric current.
Biasing refers to the application of an external DC voltage to set the operating conditions. Forward bias occurs when the external voltage reduces the built-in potential barrier, allowing significant current to flow.
Step 2: Detailed Explanation:
To achieve forward bias, the applied voltage must counteract the internal depletion layer's electric field.
- The P-side (anode), which has holes (positive charge carriers) as majority carriers, is connected to the Positive terminal of the external voltage source.
- The N-side (cathode), which has electrons (negative charge carriers) as majority carriers, is connected to the Negative terminal.
This arrangement repels holes and electrons towards the junction, shrinking the depletion region width and enabling conduction.
Step 3: Final Answer:
During forward biasing, the P-side is connected to the positive terminal.

Quick Tip

Use simple alliteration to memorize diode biasing:
Forward Bias = **P** to **P**ositive, **N** to **N**egative.
Reverse Bias is the exact opposite connection.

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11. What is the quality factor (Q) of an LCR circuit defined in terms of resonant frequency and bandwidth?
(A) $Q = \frac{\text{Bandwidth}}{f_0}$
(B) $Q = \frac{f_0}{\text{Bandwidth}}$
(C) $Q = f_0 \times \text{Bandwidth}$
(D) $Q = \frac{1}{f_0 \times \text{Bandwidth}}$

Correct Answer: (B) $Q = \frac{f_0}{\text{Bandwidth}}$

Solution:
Step 1: Understanding the Concept:

The Quality Factor (Q-factor) is a dimensionless parameter that describes how under-damped an oscillator or resonator is.
In the context of electrical tuned circuits (like an LCR circuit), it characterizes the sharpness of the resonance peak.

Step 2: Key Formula or Approach:
Mathematically, the Q-factor is defined as the ratio of the resonant frequency to the bandwidth (the difference between the upper and lower half-power frequencies).

$$Q = \frac{\text{Resonant Frequency}}{\text{Bandwidth}}$$

Step 3: Detailed Explanation:
Using standard notation, if f_0 is the resonant frequency and $\Delta f = f_2 - f_1$ is the bandwidth:

$$Q = \frac{f_0}{f_2 - f_1} = \frac{f_0}{\text{Bandwidth}}$$

A higher Q value indicates a narrower bandwidth relative to the resonant frequency, meaning the circuit is highly selective. Conversely, a lower Q value corresponds to a wider, flatter resonance curve.

Step 4: Final Answer:
The correct mathematical definition given the options is $Q = \frac{f_0}{\text{Bandwidth}}$.

> Quick Tip
>
> Another useful formula for the Quality factor of a series LCR circuit is $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$.
> It shows that reducing the resistance R significantly increases the Q-factor (sharper resonance).

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12. For a rolling solid sphere on an incline of $30°$, what is its acceleration a in terms of gravity g?
(A) $\frac{g}{2}$
(B) $\frac{5g}{7}$
(C) $\frac{5g}{7}\sin 30°$
(D) $\frac{2g}{7}\sin 30°$

Correct Answer: (C) $\frac{5g}{7}\sin 30°$

Solution:
Step 1: Understanding the Concept:
When a rigid body rolls down an inclined plane without slipping, part of its potential energy is converted into translational kinetic energy and part into rotational kinetic energy.
Because of the rotational inertia, its downward acceleration is less than that of an object simply sliding down a frictionless incline (which would be $g\sin\theta$).

Step 2: Key Formula or Approach:
The linear acceleration a of a body rolling without slipping down an incline of angle θ is given by:

$$a = \frac{g \sin\theta}{1 + \frac{I}{mR^2}}$$

where I is the moment of inertia about the center of mass, m is the mass, and R is the radius.
We can also express this using the radius of gyration K, where $I = mK^2$, making the formula:

$$a = \frac{g \sin\theta}{1 + \frac{K^2}{R^2}}$$

Step 3: Detailed Explanation:
For a solid sphere, the moment of inertia is $I = \frac{2}{5}mR^2$.
Therefore, the ratio $\frac{I}{mR^2} = \frac{2}{5}$.
Substitute this ratio and the given angle $\theta = 30°$ into the acceleration formula:

$$a = \frac{g \sin 30°}{1 + \frac{2}{5}}$$

$$a = \frac{g \sin 30°}{\frac{7}{5}}$$

$$a = \frac{5}{7} g \sin 30°$$

(Note: Since $\sin 30° = \frac{1}{2}$, the numerical value is actually $\frac{5}{14}g$, but the answer is kept in terms of $\sin 30°$ to match the given options.)
Step 4: Final Answer:
The acceleration of the rolling solid sphere is $\frac{5g}{7} \sin 30°$.

Quick Tip

Memorize the K^2/R^2 values to quickly solve rolling body problems:
- Solid Sphere: 2/5
- Hollow Sphere: 2/3
- Solid Cylinder / Disc: 1/2
- Hollow Cylinder / Ring: 1
Bodies with a lower K^2/R^2 value accelerate faster down an incline.