



INDIAN SCHOOL AL WADI AL KABIR

Unit Test 2022-23

SUB: Physics (042)

Date: 19 /01/2023

Time Allowed: One hour

Class: XI

SET 1

Maximum Marks: 30

General Instructions:

- (1) There are 16 questions. All questions are compulsory
- (2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
- (3) Section A contains nine MCQ of 1 mark each, Section B contains three questions of two marks each, Section C contains two questions of three marks each, Section D contains one long question of five marks and Section E contains one case study-based question of four marks.
- (4) There is no overall choice. However, an internal choice has been provided in section B, C D and E. You have to attempt only one of the choices in such questions.
- (5) Use of calculators is not allowed.

SECTION A [1 mark]

[1] The masses of two planets are in the ratio 1:2. Their radii are in the ratio 1:2. The acceleration due to gravity on the planets are in the ratio

- [a] 1:2
- [b] 2:1
- [c] 3:5
- [d] 5:3

[2] The gravitational potential energy at a point in the gravitational field is the

- [a] is the force needed to bring a unit mass from infinity to the given point
- [b] is the force needed to bring a given mass from infinity to the given point
- [c] is the work needed to bring a unit mass from infinity to the given point
- [d] is the work needed to bring a given mass from infinity to the given point

[3] What is the gravitational potential at infinity?

- [a] infinity
- [b] zero
- [c] -10 J
- [d] $+10\text{ J}$

[4] The masses of 2 bodies are tripled and the distance between is halved, how will the gravitational force changes?

- [a] remains the same
- [b] increases by 18 times
- [c] increases by 36 times
- [d] increases by 5 times

[5] Three wires A, B, C made of different materials elongated by 1.5,2.5,3.5mm, under a load of 5kg.If the diameters of the wires are the same, the most elastic material is that

- [a] A
- [b] B
- [c] C
- [d] D

[6] A rubber cube of side 0.5m has one side fixed, while a tangential force equal to 10N is applied to the opposite face. Find the shearing strain produced [Given rigidity modulus $G = 2 \times 10^2 \text{ N/m}^2$]

- [a] 0.4 radian
- [b] 0.2 radian
- [c] 0.1 radian
- [d] 0.3 radian

[7]The dimensional formula of shear modulus is equal to

- [a] stress
- [b] strain
- [c] Poisson's ratio
- [d] none

ASSERTION & REASON (Q. NO. 8 & 9)

Directions: Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

- (a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.
- (b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion
- (c) Assertion is correct, reason is incorrect
- (d) Assertion is incorrect, reason is correct.

[8] Assertion: The value of acceleration due to gravity i.e. 'g' is different at different places on the surface of earth.

Reason: Earth is flattened at poles and bulging out at the equator. Therefore, radius is smaller at poles and larger at equator and $g \propto 1/R^2$, so, g is smaller at equator than at poles.

OR

Assertion: Planets appear to move slower when they are farther from the sun than when they are nearer.

Reason: All planets move in elliptical orbits with sun at one of the foci of the ellipse.

[9] Assertion: Steel is more elastic than rubber

Reason: Under given deforming force, steel is deformed less than rubber

SECTION B [2 marks]

[10] Derive the expression for the total energy possessed by a satellite, when it is orbiting at a height 'h'

[11] When a wire is stretched by a certain force, its elongation is 'x'. If the second wire of the same material has four times the length and double the radius of the first wire and is stretched by the same force as before, find its elongation?

OR

A sphere contracts in volume by 0.01% when taken to the bottom of sea 1km deep. Find the bulk modulus of the material of the sphere.

Given density of water = $1000 \frac{kg}{m^3}$ & $g = 9.8m/s^2$

[12] State Kepler's I st law and second law of planetary motion

SECTION C [3marks]

[13][i] Define Hook's law

[ii] Derive the equation to find Young's modulus of a material of length L and area 'A'

OR

[i] Define Modulus of elasticity

[ii] Derive the equation to find Bulk modulus of a material of volume 'V'

[14] The radius of the Earth is reduced by 1%, mass remains the same. Find the percentage changes in escape velocity.

SECTION D [5 marks]

[15] [i] Obtain the expression to find the acceleration due to gravity on the surface of the Earth. [ii] Also derive the expression to find the acceleration due to gravity at an altitude 'h' from the surface [iii] Assuming the earth to be a uniform mass density, how much would a body weigh halfway down to the centre of the Earth if it weighed 400N on the surface? [$g = 10 \frac{m}{s^2}$]

OR

[i] What is orbital velocity of a satellite. [ii] Derive an expression to find the orbital velocity of a satellite, when it is at a height of 'h' from the surface of Earth. [iii] A body of mass 'm' is at rest at a height equal to the radius of the Earth from the surface of the Earth. It falls under gravity, what is its velocity just before touching the surface of the Earth?

SECTION E [CASE STUDY- 4 marks]

[16] Earth satellites are objects which revolve around the earth. Their motion is very similar to the motion of planets around the Sun. In particular, their orbits around the earth are circular or elliptic. Moon is the only natural satellite of the earth with a near circular orbit with a time period of approximately 27.3 days which is also roughly equal to the rotational period of the moon about its own axis. Also, if you provide sufficient energy to the satellite, it will leave the Earth without falling back to the Earth's surface

[i] Define escape velocity. [1]

[ii] Why moon don't have any atmosphere? [1]

[iii] The mass of the moon is $\frac{1}{80}$ th of the earth and the radius of the moon is $\frac{1}{4}$ th that of the earth. Given that the escape velocity from the earth's surface is 11.2 km/s. Find the escape velocity from the surface of the moon. [2]

OR

[iii] Two satellites of masses 4m and m orbit the earth in circular orbits of radius r and 4r respectively. what is the ratio of their orbital speeds? [2]