



# B.K. BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS  
A CBSE DAY-CUM-BOYS' RESIDENTIAL SCHOOL

ANNUAL EXAMINATION (2025-26)

PHYSICS (042) (SET-I)

**Class: XI**  
**Date: 12.02.26**  
**Admission no:**

**Time: 3hrs**  
**Max Marks: 70**  
**Roll no:**

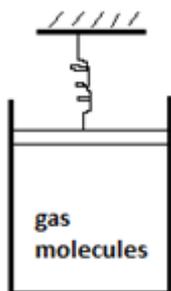
## General Instructions:

- (1) There are 33 questions in all. All questions are compulsory.
- (2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- (3) All the sections are compulsory.
- (4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
- (5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
- (6) Use of calculators is not allowed.

## SECTION-A

1. The dimensional formula of pressure is:  
(a)  $[ML^{-1}T^{-2}]$       (b)  $[MLT^{-2}]$       (c)  $[ML^2T^{-2}]$       (d)  $[M^0L^0T^0]$
2. Which of the following is a scalar quantity?  
(a) Velocity      (b) Acceleration      (c) Displacement      (d) Speed
3. The angle of projection for maximum range in projectile motion is:  
(a)  $30^\circ$       (b)  $45^\circ$       (c)  $60^\circ$       (d)  $90^\circ$
4. If two bodies are projected at  $30^\circ$  and  $60^\circ$  respectively, with the same velocity, then;  
(a) Their ranges are the same.      (b) Their heights are the same.  
(c) Their times of flight are the same.      (d) All of these
5. Which of the following is not a unit of energy?  
(a) Joule      (b) Calorie      (c) Watt      (d) kWh
6. A body in rotational motion possesses rotational kinetic energy given by .....  
(a)  $KE = \frac{1}{2} \omega I^2$       (b)  $KE = \frac{1}{2} I \omega^2$       (c)  $KE = 2 \omega I^2$       (d)  $KE = I \omega$

7. Moment of inertia depends on;  
 (a) Shape and size of the body (b) Mass (c) Position of the axis of rotation (d) All of these
8. The maximum load a wire can withstand without breaking when its length is reduced to half of its original length, will be-  
 (a) Unchanged (b) four times (c) Two times (d) Three times
9. Which liquid is used in an open-tube manometer for measuring small pressure differences?  
 (a) Oil (b) Mercury (c) Water (d) None of these
10. Water has the maximum density at  
 (a)  $4^{\circ}\text{C}$  (b)  $100^{\circ}\text{C}$  (c)  $0^{\circ}\text{C}$  (d)  $10^{\circ}\text{C}$
11. If 315cal of heat is given to the system, and the system does 20cal of work, find the change in internal energy.  
 a) 295cal (b) 335cal (c) 0 cal (d) 335J
12. In the given system, 20J of heat is supplied to the gas molecules. The spring is initially not elongated or compressed. If the spring gets compressed by 1cm. Calculate the change in internal energy of the system. Spring constant = 200N/m. Assume piston moves slowly.



- a) 19J (b) -19J (c) 21J (d) -21J

**For Questions 13 and 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.**

- (a) **If both Assertion and Reason are true and Reason is correct explanation of Assertion.**  
 (b) **If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.**  
 (c) **If Assertion is true but Reason is false.**  
 (d) **If Assertion is false but Reason is true.**

13. **Assertion:** In projectile motion, the horizontal velocity remains constant.  
**Reason:** There is no acceleration in the horizontal direction.
14. **Assertion:** Impulse of force and momentum are same physical quantities.  
**Reason:** Both quantities have same unit.
15. **Assertion:** Gravitational force between two particles is negligibly small compared to the electrical force.  
**Reason:** The electrical force is experienced by charged particles only.
16. **Assertion:** Strain is a unit less quantity.  
**Reason:** Strain is equivalent to force.

### SECTION-B

17. A projectile is thrown with velocity 20 m/s at an angle of  $60^\circ$ . Calculate the time of flight. 2

Or

A car moving along a straight highway with speed of  $126 \text{ km h}^{-1}$  is brought to a stop within a distance of 200 m. What is the retardation of the car (assumed uniform), and how long does it take for the car to stop?

18. State and explain Newton's third law of motion. 2  
19. State and prove work-energy theorem for variable force. 2  
20. Derive an expression of work done in an isothermal process. 2  
21. On an average human, the heartbeat is found to be 75 times in a minute. Calculate its beat frequency and period. 2

### SECTION-C

22. Kinetic energy 'K' of a body is given by the equation  $K = \frac{1}{2} mv^2$ , where m is mass and v is velocity. Use dimensional analysis to find the dimensional formula of kinetic energy. 3  
23. Derive the three equations of the motion, using graphical method. 3  
24. How is centripetal force provided in case of the following?  
(i) Motion of planet around the sun,  
(ii) Motion of moon around the earth.  
(iii) Motion of an electron around the nucleus in an atom. 3  
25. Prove that there will be always a loss in energy in an inelastic collision. 3  
26. A solid cylinder of mass 20kg rotates about its axis with angular speed 100 rad/sec. The radius of the cylinder is 0.25m. What is the kinetic energy associated with the rotation of the cylinder? What is the magnitude of angular momentum of the cylinder about its axis? 3  
27. A wire is fixed at one end and is subjected to increasing load at the other end. Draw a curve between stress and strain. Hence explain the terms elastic limit, Yield point, breaking point, permanent set, elastic hysteresis and elastic strength 3

Or

State and explain Bernoulli's principle for non-viscous stream line flow.

28. Which of the following examples represents (nearly) simple harmonic motion, and which represents periodic but not simple harmonic motion?  
(a) The rotation of the earth on its axis  
(b) Motion of an oscillating mercury column in a U-tube  
(c) Motion of a ball bearing inside a smooth, curved bowl, when released from a point slightly above the lowermost point 3

### SECTION-D (Case Study Based Questions)

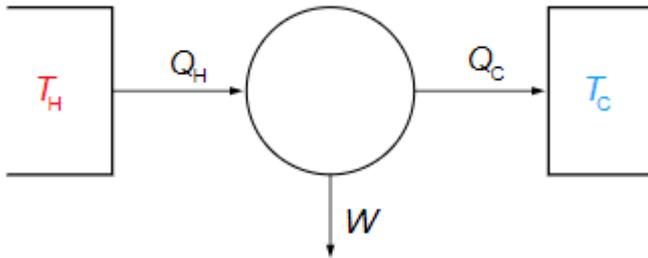
29. A car starts from rest and accelerates uniformly at  $1 \text{ m/s}^2$ . (1 + 1 + 1 + 1)  
(i) What is its velocity after 5 seconds?  
(ii) What distance does it cover in 5 seconds?  
(iii) What is the acceleration at  $t = 5 \text{ s}$ ?  
(iv) What type of motion is this?

Or

- (iv) How much more distance it will cover in next 5 seconds?

30. Read the case study given below and answer any four subparts:

Carnot principles are only for the cyclical devices like heat engines, which state that the efficiency of an irreversible heat engine is always less than the efficiency of a reversible one operating between the same two reservoirs. The efficiencies of all reversible heat engines operating between the same two reservoirs are the same.



- (i) In a Carnot cycle, the working medium rejects heat at a \_\_\_\_\_ temperature. 1  
 (a) Higher (b) Lower (c) constant (d) none of these
- (ii) Which of the following is NOT a state variable? 1  
 (a) Work (b) internal energy. (c) entropy (d) all of the above
- (iii) The efficiency of reversible heat engine is: 1  
 (a)  $1 + (T_2/T_1)$  (b)  $(T_1/T_2) + 1$  (c)  $(T_1/T_2) - 1$  (d)  $1 - (T_2/T_1)$
- (iv) Other factors remaining constant, if the temperature of the source is increased, the efficiency of the Carnot engine will: 1  
 (a) Decrease (b) increase (c) constant  
 (d) increase or decrease depending upon temperature ratio

Or

- (iv) Over the complete Carnot cycle, entropy: 1  
 (a) Increase (b) decrease (c) constant (d) first increase and then decrease

**SECTION-E**

31. What is meant by acceleration due to gravity? Obtain an expression for it in terms of mass of the earth and gravitational constant. Explain how the mass and the density of the earth can be obtained from the knowledge of G. 5

Or

What is escape speed? Obtain an expression for the escape speed on the surface of the earth. Why is it that there is no atmosphere on the moon? Explain.

32. (i) State and prove Bernoulli's Theorem with the help of suitable diagram. 5  
 (ii) The flow of blood in a large artery of an anaesthetised dog is diverted through a Venturi meter. The wider part of the meter has a cross-sectional area equal to that of the artery,  $A = 8 \text{ mm}^2$ . The narrower part has an area,  $a = 4 \text{ mm}^2$ . The pressure drop in the artery is 24 Pa. What is the speed of the blood in the artery?

Or

- (i) What are the modes of heat transfer? Explain each mode with the help of a suitable example. (ii) The coefficient of volume expansion of glycerine is  $49 \times 10^{-5} \text{ K}^{-1}$ . What is the fractional change in its density for a  $30^\circ\text{C}$  rise in temperature?

33. (i) Describe Newton's formula for velocity of sound waves in air and also discuss the Laplace's correction.

5

(ii) The speed of a wave in a certain medium is 900 m/s. If 3000 waves pass over a certain point of the medium in 2 minutes, then compute its wavelength.

Or

A body oscillates with SHM according to the equation (in SI units),  $x = 5 \cos [2\pi t + \pi/4]$ .

At  $t = 1.5$  s. As per the equation, evaluate the following:

- (a) displacement,
- (b) speed,
- (c) acceleration of the body.

----- ALL THE BEST -----