

SCO INTERNATIONAL PHYSICS OLYMPIAD

CLASS 11 SAMPLE PAPER

Sample Practice Paper | Answer Key & Explanations

Created as a clean sample-paper version following the same SCO question-paper pattern and Class 11 syllabus.

- Class 11 physics pathway covering mechanics, properties of matter, heat, thermodynamics, oscillations, and waves.
- Olympiad-style reasoning with numerical, assertion-reason, case-study, and achievers-level questions.
- PDF-ready Word layout with compact question numbers and diagrams placed inside question blocks.

Mathematics in Physics	Measurement	Kinematics	Laws of Motion	Work & Energy	Rotation
Gravitation	Solids	Fluids	Thermal Physics	Oscillations	Waves

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Candidate Guidelines

Total Questions	Time	Maximum Marks	Question Type
50	60 minutes	60	Multiple Choice Questions with one correct answer

1. Before the exam begins, candidates may use the additional time announced by the invigilator to complete the OMR/personal information section.
2. Write name, registration ID, class, school/organization details, and contact information clearly.
3. The paper has three segments: General Questions (Q1-Q30), Assertion-Reason (Q31-Q40), and Achievers Section (Q41-Q50).
4. Each Achievers Section question carries 2 marks. All other questions carry 1 mark. There is no negative marking unless separately announced by SCO.
5. Use only one response choice for each question. Calculators, smart watches, and electronic aids are not permitted.
6. For online mode, follow proctoring, camera, tab-switching, and integrity instructions exactly as displayed on the SCO platform.

Candidate Information

Name:

Registration ID: Contact No.:

School/Organization: Country:

Section A: General Physics Questions

Q1-Q30 carry 1 mark each. Choose one correct option.

Q1. What is the dimensional formula of impulse?

- A. $[M L T^{-1}]$
- B. $[M L T^{-2}]$
- C. $[M L^2 T^{-2}]$
- D. $[M^0 L T^{-1}]$

Q2. A car travels at 72 km/h. What is its speed in m/s?

- A. 10 m/s
- B. 15 m/s
- C. 20 m/s
- D. 25 m/s

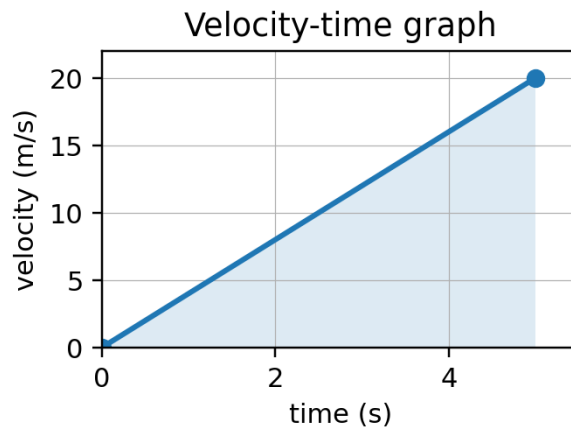
Q3. The product 12.34×2.0 should be written with correct significant figures as:

- A. 24.68
- B. 24.7
- C. 25
- D. 20

Q4. A particle has velocity $v = 5 + 2t$. What is its acceleration?

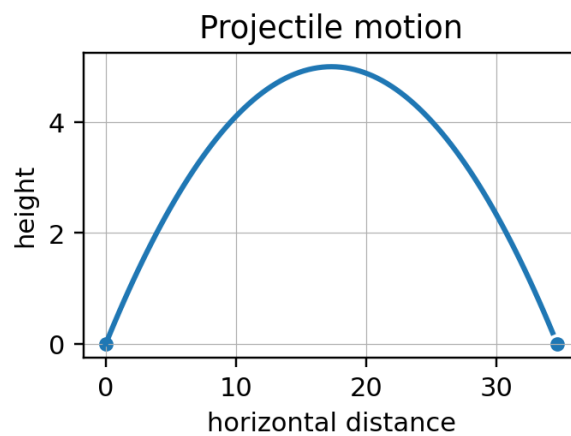
- A. 2 m/s^2
- B. 5 m/s^2
- C. 7 m/s^2
- D. It changes with time

Q5. The graph shows velocity increasing uniformly from 0 to 20 m/s in 5 s. What distance is covered?



- A. 25 m
- B. 50 m
- C. 75 m
- D. 100 m

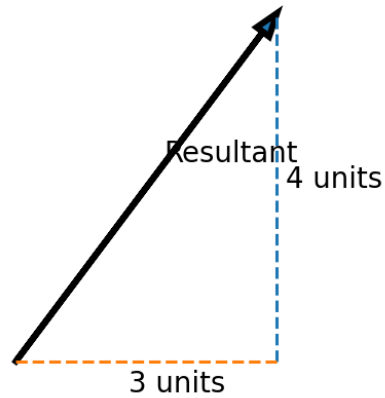
Q6. A projectile is launched at 20 m/s at 30° to the horizontal. Taking $g = 10 \text{ m/s}^2$, what is the maximum height?



- A. 2.5 m
- B. 5 m
- C. 10 m
- D. 20 m

Q7. A vector has rectangular components 3 units and 4 units. What is its magnitude?

Vector components



- A. 5 units
- B. 6 units
- C. 7 units
- D. 12 units

Q8. Two forces of 6 N and 8 N act at right angles on a point. What is their resultant?

- A. 2 N
- B. 10 N
- C. 14 N
- D. 48 N

Q9. A 2 kg block is acted on by a net force of 10 N. What is its acceleration?

- A. 2 m/s^2
- B. 5 m/s^2
- C. 10 m/s^2
- D. 20 m/s^2

Q10. A normal reaction of 50 N acts on a block. If $\mu_s = 0.4$, what is the limiting static friction?

- A. 10 N
- B. 20 N
- C. 40 N
- D. 50 N

Q11. A spring of $k = 100 \text{ N/m}$ is stretched by 0.20 m. What work is stored as elastic energy?

- A. 1 J
- B. 2 J
- C. 4 J
- D. 20 J

Q12. A machine does 600 J of work in 10 s. What is its power?

- A. 6 W
- B. 60 W
- C. 600 W
- D. 6000 W

Q13. A torque of 4 N m acts on a body with moment of inertia 2 kg m^2 . What angular acceleration is produced?

- A. 0.5 rad/s^2
- B. 2 rad/s^2
- C. 4 rad/s^2
- D. 8 rad/s^2

Q14. Two equal masses are placed at $x = 0 \text{ m}$ and $x = 4 \text{ m}$. Where is their centre of mass?

- A. 1 m
- B. 2 m
- C. 3 m
- D. 4 m

Q15. If the distance between two masses is doubled, how does the gravitational force change?

- A. It becomes one-fourth
- B. It becomes half
- C. It doubles
- D. It becomes four times

Q16. The escape speed from a planet is related to the orbital speed close to its surface by:

- A. $v_e = v_o/2$
- B. $v_e = v_o$
- C. $v_e = \sqrt{2}v_o$
- D. $v_e = 2v_o$

Q17. A force of 100 N acts over an area of 0.01 m^2 . What pressure is exerted?

- A. 100 Pa
- B. 1000 Pa
- C. 10,000 Pa
- D. 100,000 Pa

Q18. An object displaces 0.003 m^3 of water. Taking density of water = 1000 kg/m^3 and $g = 10 \text{ m/s}^2$, what is the buoyant force?

- A. 3 N
- B. 30 N
- C. 300 N
- D. 3000 N

Q19. In a steady incompressible flow, the area of a pipe suddenly becomes half. What happens to the flow speed?

- A. It becomes one-fourth
- B. It becomes half
- C. It remains the same
- D. It doubles

Q20. For an isotropic solid, coefficient of volume expansion is approximately:

- A. α
- B. 2α
- C. 3α
- D. $\alpha/3$

Q21. 27°C is approximately equal to:

- A. 100 K
- B. 273 K
- C. 300 K
- D. 327 K

Q22. A 2 kg metal block of specific heat $500\text{ J kg}^{-1}\text{ K}^{-1}$ is heated through 10 K. How much heat is absorbed?

- A. 1000 J
- B. 5000 J
- C. 10,000 J
- D. 20,000 J

Q23. During an isothermal expansion of an ideal gas, volume doubles. What happens to pressure?

- A. It becomes half
- B. It remains unchanged
- C. It doubles
- D. It becomes four times

Q24. In an adiabatic expansion of a gas doing work, what generally happens to its temperature?

- A. It increases
- B. It decreases
- C. It remains always constant
- D. It becomes zero immediately

Q25. A monatomic ideal gas molecule has how many translational degrees of freedom?

- A. 1
- B. 2
- C. 3
- D. 5

Q26. The average kinetic energy of an ideal gas molecule is proportional to:

- A. pressure only
- B. volume only
- C. absolute temperature
- D. density only

Q27. In SHM, displacement $x = A$ at an extreme position. What is the magnitude of acceleration there?

- A. 0
- B. ωA
- C. $\omega^2 A$
- D. A/ω^2

Q28. For small oscillations, the period of a simple pendulum is independent of:

- A. length
- B. local value of g
- C. mass of the bob
- D. amplitude if large

Q29. A sound wave of frequency 170 Hz travels in air at 340 m/s. What is its wavelength?

- A. 0.5 m
- B. 1 m
- C. 2 m
- D. 4 m

Q30. Two tuning forks of frequencies 256 Hz and 261 Hz are sounded together. What beat frequency is heard?

- A. 2 Hz
- B. 5 Hz
- C. 256 Hz
- D. 517 Hz

Section B: Assertion-Reason Questions

Q31-Q40 carry 1 mark each. Use the option key given in each question.

Q31. Assertion (A): Dimensional analysis can verify whether an equation is possibly correct.

Reason (R): A dimensionally wrong equation cannot be physically correct.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q32. Assertion (A): The slope of a displacement-time graph gives velocity.

Reason (R): Velocity is the rate of change of displacement with time.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q33. Assertion (A): A body moving with uniform speed can still have acceleration.

Reason (R): Acceleration can occur when direction of velocity changes.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q34. Assertion (A): Work done by static friction is always zero.

Reason (R): The point of contact under pure rolling is instantaneously at rest.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q35. Assertion (A): A satellite in circular orbit has negative total mechanical energy.

Reason (R): Its kinetic energy is half the magnitude of its potential energy.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q36. Assertion (A): A liquid meniscus can rise in a narrow capillary tube.

Reason (R): Surface tension and adhesive forces can pull the liquid upward against gravity.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q37. Assertion (A): In an ideal gas, internal energy depends only on temperature.

Reason (R): Ideal gas molecules have no potential energy of intermolecular interaction.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q38. Assertion (A): The second law of thermodynamics permits complete conversion of heat into work in a cyclic engine.
Reason (R): Heat naturally flows from hot bodies to cold bodies.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q39. Assertion (A): The period of a mass-spring oscillator increases if mass is increased.
Reason (R): $T = 2\pi\sqrt{m/k}$.

- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Q40. Assertion (A): In a stationary wave, all particles between two adjacent nodes are in the same phase.
Reason (R): Adjacent nodes are separated by one wavelength.

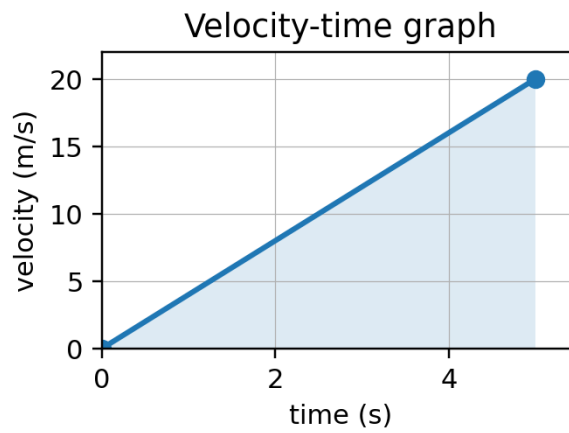
- A. Both A and R are true, and R correctly explains A
- B. Both A and R are true, but R does not explain A
- C. A is true, R is false
- D. A is false, R is true

Section C: Achievers Section

Q41-Q50 carry 2 marks each. Read each case carefully and choose one correct option.

Q41. Case Study: A school bus starts from rest and accelerates uniformly at 2 m/s^2 for 8 s, then moves with the speed reached for the next 7 s.

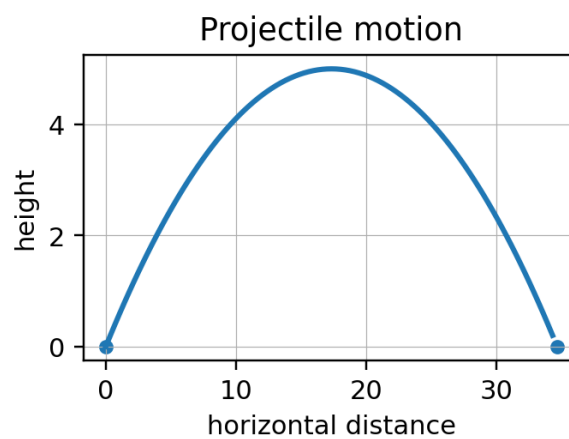
Q41. What is the total distance covered in 18 s?



- A. 144 m
- B. 160 m
- C. 176 m
- D. 200 m

Q42. Case Study: A stone is projected with velocity 30 m/s at 45° above horizontal. Take $g = 10 \text{ m/s}^2$.

Q42. What is the approximate horizontal range?



- A. 45 m
- B. 60 m
- C. 90 m
- D. 120 m

Q43. Case Study: A 4 kg block moving at 5 m/s collides elastically with a stationary 1 kg block in a straight line.

Q43. What is the speed of the 1 kg block after collision?

- A. 2 m/s
- B. 4 m/s
- C. 6 m/s
- D. 8 m/s

Q44. Case Study: A solid cylinder rolls without slipping with speed 4 m/s. Its mass is 3 kg and $I = (1/2)MR^2$.

Q44. What is its total kinetic energy?

- A. 24 J
- B. 36 J
- C. 48 J
- D. 72 J

Q45. Case Study: A satellite of mass m orbits Earth in a circular orbit of radius r .

Q45. What is its total mechanical energy?

- A. $-GMm/r$
- B. $-GMm/(2r)$
- C. $GMm/(2r)$
- D. GMm/r

Q46. Case Study: A wire of length 2 m and area $2 \times 10^{-6} \text{ m}^2$ extends by 1 mm under a load of 100 N.

Q46. What is the Young's modulus of the wire?

- A. $1.0 \times 10^{10} \text{ Pa}$
- B. $5.0 \times 10^{10} \text{ Pa}$
- C. $1.0 \times 10^{11} \text{ Pa}$
- D. $2.0 \times 10^{11} \text{ Pa}$

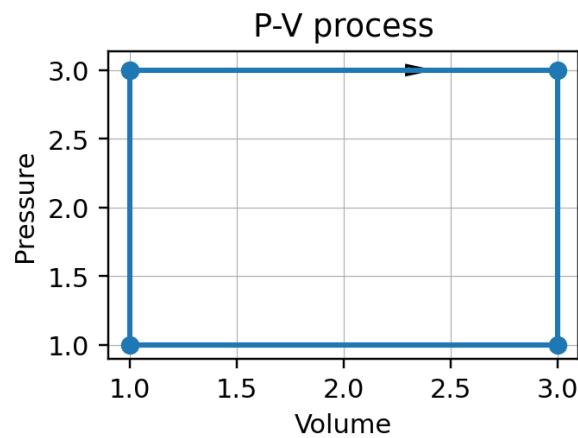
Q47. Case Study: Water flows through a horizontal pipe. At a wide section, area is 4 cm^2 and speed is 2 m/s . At a narrow section, area is 1 cm^2 .

Q47. What is the speed at the narrow section?

- A. 2 m/s
- B. 4 m/s
- C. 6 m/s
- D. 8 m/s

Q48. Case Study: One mole of an ideal gas expands isothermally at 300 K from volume V to $2V$. Use $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ and $\ln 2 = 0.693$.

Q48. What work is done by the gas?



- A. 863 J
- B. 1230 J
- C. 1728 J
- D. 2494 J

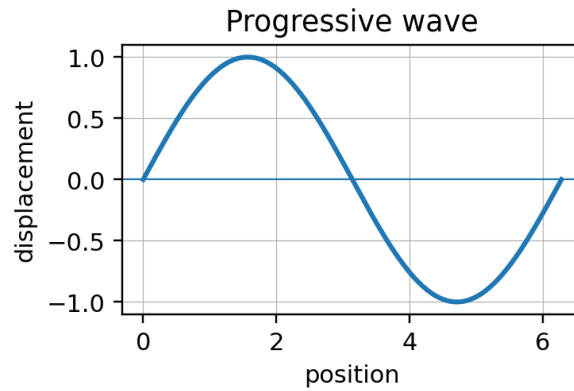
Q49. Case Study: A 0.20 kg body performs SHM with amplitude 0.10 m and angular frequency 20 rad/s .

Q49. What is its total energy?

- A. 0.2 J
- B. 0.4 J
- C. 0.8 J
- D. 1.6 J

Q50. Case Study: A string of length 1.0 m is fixed at both ends. Wave speed on the string is 120 m/s.

Q50. What is the fundamental frequency?



- A. 30 Hz
- B. 60 Hz
- C. 120 Hz
- D. 240 Hz

Answer Key

Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.
1	A	11	B	21	C	31	A	41	C
2	C	12	B	22	C	32	A	42	C
3	C	13	B	23	A	33	A	43	D
4	A	14	B	24	B	34	D	44	B
5	B	15	A	25	C	35	A	45	B
6	B	16	C	26	C	36	A	46	C
7	A	17	C	27	C	37	A	47	D
8	B	18	B	28	C	38	D	48	C
9	B	19	D	29	C	39	A	49	B
10	B	20	C	30	B	40	C	50	B

Detailed Explanations

<p>Q1. Answer: A. Impulse = force x time, so dimensions are $[M L T^{-2}][T] = [M L T^{-1}]$.</p>
<p>Q2. Answer: C. $72 \text{ km/h} = 72 \times 1000/3600 = 20 \text{ m/s}$.</p>
<p>Q3. Answer: C. 2.0 has two significant figures, so the product 24.68 is rounded to two significant figures: 25.</p>
<p>Q4. Answer: A. Acceleration is dv/dt. Since $v = 5 + 2t$, $a = 2 \text{ m/s}^2$.</p>
<p>Q5. Answer: B. Distance is area under v-t graph = $(1/2) \times \text{base} \times \text{height} = (1/2) \times 5 \times 20 = 50 \text{ m}$.</p>
<p>Q6. Answer: B. Vertical component $u_y = 20 \sin 30^\circ = 10 \text{ m/s}$. Maximum height = $u_y^2/(2g) = 100/20 = 5 \text{ m}$.</p>
<p>Q7. Answer: A. Magnitude = $\sqrt{3^2 + 4^2} = 5 \text{ units}$.</p>
<p>Q8. Answer: B. Resultant = $\sqrt{6^2 + 8^2} = 10 \text{ N}$.</p>
<p>Q9. Answer: B. Using $F = ma$, $a = F/m = 10/2 = 5 \text{ m/s}^2$.</p>
<p>Q10. Answer: B. Limiting friction = $\mu sN = 0.4 \times 50 = 20 \text{ N}$.</p>
<p>Q11. Answer: B. Elastic energy = $(1/2)kx^2 = 0.5 \times 100 \times 0.04 = 2 \text{ J}$.</p>
<p>Q12. Answer: B. Power = work/time = $600/10 = 60 \text{ W}$.</p>

Q13. Answer: B. $\tau = I\alpha$, so $\alpha = \tau/I = 4/2 = 2 \text{ rad/s}^2$.

Q14. Answer: B. For equal masses, the centre of mass lies at the midpoint: 2 m.

Q15. Answer: A. Gravitational force varies inversely as r^2 . Doubling distance makes force one-fourth.

Q16. Answer: C. Escape speed $\sqrt{2GM/R}$, while close orbital speed $\sqrt{GM/R}$, so $v_e = \sqrt{2}v_o$.

Q17. Answer: C. Pressure = force/area = $100/0.01 = 10,000 \text{ Pa}$.

Q18. Answer: B. Buoyant force = $\rho gV = 1000 \times 10 \times 0.003 = 30 \text{ N}$.

Q19. Answer: D. Continuity equation gives $A_1v_1 = A_2v_2$. If area halves, speed doubles.

Q20. Answer: C. For isotropic solids, volume expansion coefficient $\beta \approx 3\alpha$.

Q21. Answer: C. Kelvin temperature = Celsius + 273. $27 + 273 = 300 \text{ K}$.

Q22. Answer: C. $Q = mc\Delta T = 2 \times 500 \times 10 = 10,000 \text{ J}$.

Q23. Answer: A. For isothermal process, $PV = \text{constant}$. If volume doubles, pressure becomes half.

Q24. Answer: B. In adiabatic expansion with no heat supply, work is done at the expense of internal energy, so temperature decreases.

Q25. Answer: C. A molecule can move independently along x, y and z directions; hence 3 translational degrees of freedom.

Q26. Answer: C. Kinetic theory gives average translational kinetic energy = $(3/2)kT$.

Q27. Answer: C. For SHM, $a = -\omega^2x$. At $x = A$, magnitude is ω^2A .

Q28. Answer: C. $T = 2\pi\sqrt{l/g}$, which does not contain mass.

Q29. Answer: C. Wavelength $\lambda = v/f = 340/170 = 2 \text{ m}$.

Q30. Answer: B. Beat frequency = $|f_1 - f_2| = |261 - 256| = 5 \text{ Hz}$.

Q31. Answer: A. Dimensional analysis is a necessary test. If dimensions differ on two sides, the equation cannot be correct.

Q32. Answer: A. The slope $\Delta x/\Delta t$ or dx/dt is exactly the velocity.

Q33. Answer: A. Uniform circular motion has constant speed but changing velocity direction, so it has centripetal acceleration.

Q34. Answer: D. The assertion is not always true; static friction can do work in some situations. The reason is true for ideal pure rolling contact.

Q35. Answer: A. For circular orbit, $K = GMm/(2r)$ and $U = -GMm/r$, so total energy = $-GMm/(2r)$, which is negative.

Q36. Answer: A. Capillary rise is caused by surface tension and adhesion overcoming weight of the raised liquid column.

Q37. Answer: A. With no intermolecular potential energy, internal energy is entirely kinetic and depends on absolute temperature.

Q38. Answer: D. The assertion is false: no cyclic engine can convert all heat into work. The reason is true but not a justification for the false assertion.

Q39. Answer: A. The formula shows T is proportional to \sqrt{m} , so increasing mass increases period.

Q40. Answer: C. Particles between adjacent nodes are in phase, but adjacent nodes are separated by $\lambda/2$, not one wavelength.

Q41. Answer: C. In the first 8 s, $s_1 = (1/2)at^2 = (1/2)(2)(64) = 64$ m and final speed = 16 m/s. In the next 7 s, $s_2 = 16 \times 7 = 112$ m. Total distance = $64 + 112 = 176$ m.

Q42. Answer: C. $R = u^2 \sin 2\theta / g = 900 \times \sin 90^\circ / 10 = 90$ m.

Q43. Answer: D. For a 1D elastic collision with second mass initially at rest, $v_2 = 2m_1u_1 / (m_1 + m_2) = 2 \times 4 \times 5 / (5) = 8$ m/s.

Q44. Answer: B. Total KE = $(1/2)Mv^2 + (1/2)I\omega^2 = (1/2)Mv^2 + (1/4)Mv^2 = (3/4)Mv^2 = 0.75 \times 3 \times 16 = 36$ J.

Q45. Answer: B. For circular orbit, $K = GMm / (2r)$ and $U = -GMm / r$. Total $E = K + U = -GMm / (2r)$.

Q46. Answer: C. $Y = (F/A) / (\Delta L/L) = FL / (A\Delta L) = 100 \times 2 / [(2 \times 10^{-6})(1 \times 10^{-3})] = 1.0 \times 10^{11}$ Pa.

Q47. Answer: D. Using continuity, $A_1v_1 = A_2v_2$. So $v_2 = (4/1) \times 2 = 8$ m/s.

Q48. Answer: C. For isothermal expansion, $W = nRT \ln(V_2/V_1) = 1 \times 8.314 \times 300 \times 0.693 \approx 1728$ J.

Q49. Answer: B. Total energy = $(1/2)m\omega^2A^2 = 0.5 \times 0.20 \times 400 \times 0.01 = 0.4$ J.

Q50. Answer: B. For a string fixed at both ends, $f_1 = v / (2L) = 120 / (2 \times 1.0) = 60$ Hz.