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SCO INTERNATIONAL OLYMPIAD

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SCO INTERNATIONAL PHYSICS OLYMPIAD

Sample Paper with Answer Key & Explanations

Motion	Force & Laws	Gravitation
Work & Energy	Sound	Applied Reasoning

Candidate Information

Candidate Details	
Name	.....
Registration ID	.....
Contact No.	.....
School / Organization	.....

Question Paper

General Questions

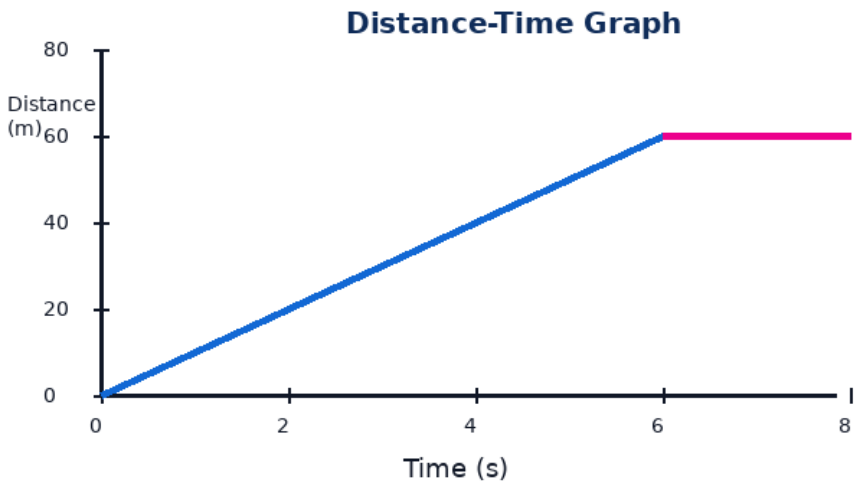
Q1. A cyclist travels 90 m in 15 seconds. What is the speed?

A. 3 m/s	**B.** 4 m/s
C. 5 m/s	**D.** 6 m/s

Q2. A car moving at 5 m/s accelerates uniformly to 25 m/s in 10 s. What is its acceleration?

A. 1 m/s^2	**B.** 2 m/s^2
C. 3 m/s^2	**D.** 4 m/s^2

Q3. In the graph shown, the slope of a distance-time graph represents:



A. mass	**B.** speed
C. force	**D.** energy

Q4. A force of 12 N acts on a 3 kg object. What acceleration is produced?

A. 2 m/s^2	**B.** 3 m/s^2
C. 4 m/s^2	**D.** 6 m/s^2

Q5. A dust particle remains on a card when the card is slowly moved but falls into a glass when the card is flicked quickly. This mainly shows:

A. reflection	**B.** inertia
C. echo	**D.** buoyancy

Q6. A 4 kg object has velocity 3 m/s. Its momentum is:

A. 7 kg m/s	**B.** 12 kg m/s
C. 16 kg m/s	**D.** 24 kg m/s

Q7. Which is an action-reaction pair?

A. Book weight and table normal on same book	**B.** Earth pulls stone and stone pulls Earth
C. Friction and air pressure	**D.** Mass and weight

Q8. If g on Moon is about one-sixth of Earth, a 60 N object on Earth weighs about how much on the Moon?

A. 6 N	**B.** 10 N
C. 30 N	**D.** 60 N

Q9. A ball is thrown vertically upward. At the highest point, its instantaneous velocity is:

A. maximum upward	**B.** maximum downward
C. zero	**D.** equal to acceleration

Q10. The SI unit of work is:

A. watt	**B.** newton
C. joule	**D.** pascal

Q11. A student carries a bag and walks on a level road. Work done against gravity on the bag is approximately:

A. zero	**B.** positive
C. negative	**D.** infinite

Q12. Kinetic energy of a moving body depends on:

A. mass and speed	**B.** colour only
C. temperature only	**D.** shape only

Q13. Which device converts electrical energy into sound energy?

A. speaker	**B.** solar cell
C. battery only	**D.** barometer

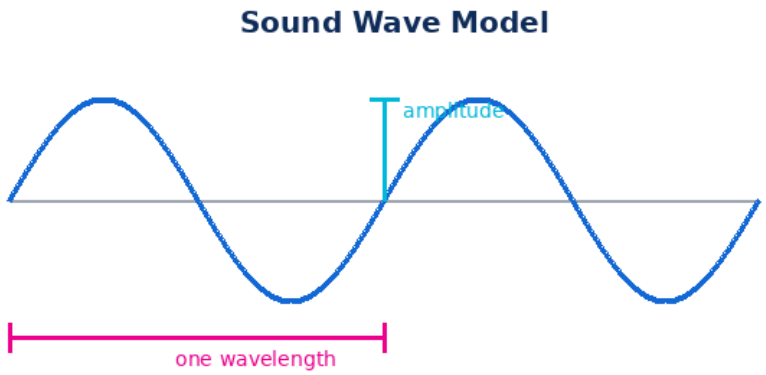
Q14. A 2 kg mass is raised by 5 m. Taking g = 10 m/s^2, potential energy gained is:

A. 10 J	**B.** 25 J
C. 50 J	**D.** 100 J

Q15. What is power if 900 J work is done in 30 s?

A. 15 W	**B.** 30 W
C. 60 W	**D.** 90 W

Q16. The diagram represents a sound wave. The vertical height from the midline to the crest is called:



A. frequency	**B.** amplitude
C. speed	**D.** period

Q17. A wave has frequency 100 Hz and wavelength 3.4 m. Its speed is:

A. 34 m/s	**B.** 100 m/s
C. 340 m/s	**D.** 680 m/s

Q18. Which surface is most likely to produce a clear echo?

A. soft curtain	**B.** thick carpet
C. hard wall	**D.** open field only

Q19. A bat uses reflected ultrasonic waves to locate insects. This is an example of:

A. reflection of sound	**B.** dispersion of light
C. electrolysis	**D.** evaporation

Q20. Which sound has the highest pitch?

A. 50 Hz	**B.** 200 Hz
C. 1000 Hz	**D.** 30 Hz

Q21. A car is moving with uniform velocity. Which statement is true?

A. Acceleration is zero	**B.** Force must be increasing
C. Speed is zero	**D.** Direction changes every second

Q22. Which of the following is a scalar quantity?

A. velocity	**B.** force
C. displacement	**D.** speed

Q23. An object moving in a circle at constant speed has changing:

A. mass	**B.** speed
C. direction of velocity	**D.** energy only

Q24. If a stone and feather are dropped in air, the feather falls slower mainly due to:

A. lower gravity	**B.** air resistance
C. larger mass	**D.** higher temperature

Q25. A body does 200 J of work and loses 50 J as heat. Useful energy output is:

A. 50 J	**B.** 100 J
C. 150 J	**D.** 250 J

Q26. The law of conservation of energy says energy:

A. can be created from nothing	**B.** can be destroyed completely
C. can change form but total remains constant	**D.** exists only as heat

Q27. A sound takes 0.5 s to travel from a source to a listener 170 m away. Speed of sound is:

A. 85 m/s	**B.** 170 m/s
C. 340 m/s	**D.** 680 m/s

Q28. Reverberation in a hall can be reduced by using:

A. hard metal sheets	**B.** sound absorbing curtains
C. more empty walls	**D.** glass mirrors only

Q29. The force needed to give a 5 kg body an acceleration of 2 m/s^2 is:

A. 2.5 N	**B.** 7 N
C. 10 N	**D.** 20 N

Q30. If the speed of a body doubles, its kinetic energy becomes:

A. half	**B.** double
C. three times	**D.** four times

Assertion-Reason Questions

Q31. Assertion: A moving bus stops when brakes are applied. Reason: The braking force acts opposite to the direction of motion.

A. A. Both true and Reason explains Assertion	**B.** B. Both true but Reason does not explain Assertion
C. C. Assertion true, Reason false	**D.** D. Assertion false, Reason true

Q32. Assertion: A body can have zero velocity but non-zero acceleration. Reason: At the top of vertical motion, velocity is zero but acceleration due to gravity acts downward.

A. A	**B.** B
C. C	**D.** D

Q33. Assertion: Momentum of a body depends on mass and velocity. Reason: Momentum is equal to force divided by time.

A. A	**B.** B
C. C	**D.** D

Q34. Assertion: Work done is zero if displacement is zero. Reason: Work is calculated as force multiplied by displacement in the direction of force.

A. A	**B.** B
C. C	**D.** D

Q35. Assertion: Ultrasound has frequency above the audible range of humans. Reason: Human ears normally hear above 20,000 Hz.

A. A	**B.** B
C. C	**D.** D

Q36. Assertion: The weight of an object is less on the Moon than on Earth. Reason: The Moon's gravitational acceleration is less than Earth's.

A. A	**B.** B
C. C	**D.** D

Q37. Assertion: Echo is a reflection of sound. Reason: Sound can bounce from a hard surface.

A. A	**B.** B
C. C	**D.** D

Q38. Assertion: A satellite in orbit is continuously falling around Earth. Reason: Gravity provides centripetal acceleration.

A. A	**B.** B

C. C	**D.** D

Q39. Assertion: Energy is measured in joules. Reason: Power is measured in newtons.

A. A	**B.** B
C. C	**D.** D

Q40. Assertion: A sound wave travels faster in solids than in gases in many cases. Reason: Particles in solids can pass vibrations efficiently.

A. A	**B.** B
C. C	**D.** D

Case Study Questions

Q41. Case: A toy car moves 10 m in 2 s, stops for 3 s, then moves 15 m in 5 s. What is total average speed?

A. 2 m/s	**B.** 2.5 m/s
C. 3 m/s	**D.** 5 m/s

Q42. Case: A student lifts a 3 kg book to a shelf 2 m high. Take g = 10 m/s^2. Work done is:

A. 6 J	**B.** 15 J
C. 30 J	**D.** 60 J

Q43. Case: A school measures echo from a wall 85 m away. If speed of sound is 340 m/s, after how much time will the echo be heard?

A. 0.25 s	**B.** 0.5 s
C. 1.0 s	**D.** 2.0 s

Q44. Case: A 1 kg ball moving at 12 m/s is stopped by a goalkeeper in 0.4 s. Average stopping force is:

A. 12 N	**B.** 24 N
C. 30 N	**D.** 48 N

Q45. Case: A truck and a small car move at the same speed. Which has more kinetic energy?

A. Truck	**B.** Car
C. Both equal	**D.** Depends only on colour

Achievers Section

Q46. A cyclist accelerates uniformly from 2 m/s to 10 m/s in 4 s and then continues at 10 m/s for 6 s. Total distance is:

A. 24 m	**B.** 36 m
C. 48 m	**D.** 84 m

Q47. A 0.5 kg ball moving at 20 m/s hits a wall and rebounds at 10 m/s in the opposite direction. Magnitude of change in momentum is:

A. 5 kg m/s	**B.** 10 kg m/s
C. 15 kg m/s	**D.** 20 kg m/s

Q48. A machine is 80% efficient and receives 1000 J input energy. Useful output is:

A. 80 J	**B.** 200 J
C. 800 J	**D.** 1000 J

Q49. A ship sends a sound pulse to the seabed. Echo returns in 3 s. Speed in seawater is 1500 m/s. Depth is:

A. 1500 m	**B.** 2250 m
C. 3000 m	**D.** 4500 m

Q50. A 2 kg object moving at 4 m/s speeds up to 8 m/s. Increase in kinetic energy is:

A. 16 J	**B.** 32 J
C. 48 J	**D.** 64 J

Answer Key

Q / Ans	Q / Ans	Q / Ans	Q / Ans	Q / Ans
1. D	2. B	3. B	4. C	5. B
6. B	7. B	8. B	9. C	10. C
11. A	12. A	13. A	14. D	15. B
16. B	17. C	18. C	19. A	20. C
21. A	22. D	23. C	24. B	25. C
26. C	27. C	28. B	29. C	30. D
31. A	32. A	33. C	34. A	35. C
36. A	37. A	38. A	39. C	40. A
41. B	42. D	43. B	44. C	45. A
46. D	47. C	48. C	49. B	50. C

Detailed Explanations

Q1 (D): Speed = distance/time = 90/15 = 6 m/s.

Q2 (B): Acceleration = (25 - 5)/10 = 2 m/s^2.

Q3 (B): Slope of a distance-time graph gives speed.

Q4 (C): Using F = ma, a = 12/3 = 4 m/s^2.

Q5 (B): The particle tends to remain at rest due to inertia when the card is suddenly flicked.

Q6 (B): p = mv = 4 × 3 = 12 kg m/s.

Q7 (B): Earth pulls the stone and the stone pulls Earth with equal and opposite gravitational forces.

Q8 (B): Moon weight ≈ 60/6 = 10 N.

Q9 (C): At the highest point the ball momentarily stops before coming down, so velocity is zero.

Q10 (C): Work is measured in joules.

Q11 (A): The upward force on the bag is perpendicular to horizontal displacement; no work is done against gravity.

Q12 (A): KE = 1/2 mv^2, so it depends on mass and speed.

Q13 (A): A speaker uses electrical signals to make a diaphragm vibrate, producing sound.

Q14 (D): PE = mgh = 2 × 10 × 5 = 100 J.

Q15 (B): Power = 900/30 = 30 W.

Q16 (B): Amplitude is the maximum displacement from the mean position.

Q17 (C): Speed = frequency × wavelength = 100 × 3.4 = 340 m/s.

Q18 (C): Hard, smooth surfaces reflect sound better and can produce a clear echo.

Q19 (A): Bats use echolocation based on reflected ultrasound.

Q20 (C): Pitch increases with frequency; 1000 Hz is highest.

Q21 (A): Uniform velocity means constant speed and direction, so acceleration is zero.

Q22 (D): Speed has magnitude only and no direction.

Q23 (C): The direction of velocity changes continuously in circular motion.

Q24 (B): Air resistance affects the feather more, so it falls slower in air.

Q25 (C): Useful energy = 200 - 50 = 150 J.

Q26 (C): Energy can transform from one form to another but total energy remains conserved in an isolated system.

Q27 (C): Speed = distance/time = 170/0.5 = 340 m/s.

Q28 (B): Soft materials absorb sound and reduce repeated reflections.

Q29 (C): F = ma = 5 × 2 = 10 N.

Q30 (D): KE is proportional to v^2; doubling speed makes KE four times.

Q31 (A): A force opposite to motion causes deceleration and can stop the bus.

Q32 (A): At the highest point of vertical throw, instantaneous velocity is zero but acceleration is g downward.

Q33 (C): Momentum equals mass × velocity, not force/time.

Q34 (A): If displacement is zero, work done is zero even if force is applied.

Q35 (C): Ultrasound is above 20,000 Hz, but normal human hearing is up to about 20,000 Hz, not above it.

Q36 (A): Weight = mg, so lower g gives lower weight.

Q37 (A): Echo results from reflected sound waves from hard surfaces.

Q38 (A): The satellite keeps falling toward Earth but also moves forward, creating orbit.

Q39 (C): Energy is measured in joules, but power is measured in watts, not newtons.

Q40 (A): Solids generally transmit sound faster due to stronger particle interactions.

Q41 (B): Total distance = 25 m; total time = 10 s. Average speed = 2.5 m/s.

Q42 (D): Work = mgh = 3 × 10 × 2 = 60 J.

Q43 (B): Sound travels 85 m to wall and 85 m back, total 170 m. Time = 170/340 = 0.5 s.

Q44 (C): Change in momentum = 12 kg m/s. Force = 12/0.4 = 30 N.

Q45 (A): At the same speed, KE is proportional to mass, so the heavier truck has more kinetic energy.

Q46 (D): Acceleration phase distance = (2+10)/2 × 4 = 24 m. Constant speed distance = 10 × 6 = 60 m. Total = 84 m.

Q47 (C): Take initial momentum +10 kg m/s and final -5 kg m/s. Change magnitude = 15 kg m/s.

Q48 (C): Useful output = 0.80 × 1000 = 800 J.

Q49 (B): Total path = 1500 × 3 = 4500 m. Depth = 4500/2 = 2250 m.

Q50 (C): Initial KE = 1/2 × 2 × 4^2 = 16 J. Final KE = 1/2 × 2 × 8^2 = 64 J. Increase = 48 J.

Space for Rough Work