Class 9: Science
Chapter: How Forces Affect Motion

Maximum Marks: 50
Time: 1 Hours

SECTION A – (1 mark each)

Q1. A box is pushed with a force of 40 N towards east. Friction of 15 N acts towards west. The net force on the box is:

(a) 55 N east
(b) 25 N east
(c) 25 N west
(d) 55 N west

Q2. A body is moving with constant velocity on a horizontal road. The net force acting on it is:

(a) Zero
(b) Constant and non-zero
(c) Increasing
(d) Equal to its weight

Q3. A hockey player hits a ball with greater force. Which physical quantity definitely increases immediately after the hit?

(a) Mass
(b) Acceleration
(c) Friction
(d) Weight

Q4. Two students pull a rope in opposite directions with forces 120 N and 150 N respectively. The rope moves:

(a) Towards 120 N force
(b) Towards 150 N force
(c) Does not move
(d) Upward

Q5. A car suddenly stops. The passenger bends forward due to:

(a) Newton's third law
(b) Friction
(c) Inertia of motion
(d) Gravitational force

Q6. The SI unit of force is:

(a) kg m s^{-1}
(b) kg m s^{-2}
(c) N m
(d) kg s^{-2}

Q7. A 5 kg object experiences an acceleration of 4 ms^{-2}. The net force acting on it is:

F=ma

(a) 1.25 N
(b) 9 N
(c) 20 N
(d) 45 N

Q8. Which situation has the LEAST friction?

(a) Wooden block on rough concrete
(b) Wooden block on polished marble
(c) Wooden block on sandpaper
(d) Wooden block on grass

Q9. A rocket moves upward because:

(a) Air pushes it upward
(b) Gravity pulls it upward
(c) Exhaust gases exert equal and opposite force on the rocket
(d) The rocket becomes lighter

Q10. A force pair according to Newton's third law acts on:

(a) Same object in same direction
(b) Same object in opposite directions
(c) Different objects in opposite directions
(d) Different objects in same direction

SECTION B – ASSERTION & REASON **(2 marks each)**

For the following questions, choose the correct option:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q11. **Assertion (A):** An object moving with constant velocity can have zero net force acting on it.
Reason (R): Constant velocity means acceleration is zero.

Q12. **Assertion (A):** It is difficult to walk on an oily floor.
Reason (R): Friction between the floor and feet decreases.

Q13. **Assertion (A):** A cricket player moves hands backward while catching the ball.
Reason (R): Increasing stopping time reduces force experienced.

Q14. **Assertion (A):** A heavier truck requires more force than a car to produce the same acceleration.
Reason (R): Acceleration is inversely proportional to mass.

Q15. **Assertion (A):** Action and reaction forces cancel each other.
Reason (R): Action and reaction forces act on different objects.

SECTION C – SHORT ANSWER QUESTIONS (3 marks each)

Q16. A force of 80 N acts on a 20 kg object moving on a frictionless surface.

(i) Calculate its acceleration.
(ii) Find the velocity after 5 s if initial velocity is zero.
(iii) State the direction of acceleration.

Q17. A student pushes a stationary 15 kg box with a force of 40 N. Friction opposing motion is 25 N.

(i) Find the net force.
(ii) Calculate acceleration.
(iii) Explain whether the motion is balanced or unbalanced.

Q18. Explain with examples the difference between balanced and unbalanced forces. Also state their effect on motion.

Q19. Why do passengers in buses fall backward when the bus suddenly starts moving? Explain using Newton's laws.

Q20. A balloon tied with a straw moves forward when air escapes backward.

(i) Identify the law involved.
(ii) Explain the action-reaction pair.
(iii) Why does the balloon accelerate forward?

SECTION D – CASE BASED QUESTIONS (4 marks each)

Q21. Case Study: Tug of War

During sports day, two teams participated in tug of war. Initially both teams pulled equally and the rope did not move. Suddenly Team A pulled harder and the rope started moving toward Team A.

Answer the following:

(i) What type of forces acted initially? (1)
(ii) Why did the rope start moving later? (1)
(iii) If Team A applied 450 N and Team B applied 390 N, calculate the net force. (1)
(iv) Name the law that explains why acceleration occurs when net force acts. (1)

Q22. Case Study: Rocket Launch

A rocket expels gases downward at very high speed during launch. The rocket then rises upward against gravity.

Answer the following:

(i) Which law explains rocket motion? (1)
(ii) Identify the action force. (1)
(iii) Identify the reaction force. (1)
(iv) Why must the upward force exceed the rocket's weight during launch? (1)

Q23. Case Study: Friction Investigation

A student released identical coin stacks on wooden, tiled, and polished marble surfaces using a stretched rubber band. The coins travelled the maximum distance on polished marble.

Answer the following:

(i) Which surface had minimum friction? (1)
(ii) On which surface was velocity reduced fastest? (1)
(iii) Why does friction reduce motion? (1)
(iv) If friction suddenly became zero everywhere, what would happen to a moving object? (1)

Q24. Case Study: Airbags in Cars

Modern cars contain airbags that inflate instantly during collisions.

Answer the following:

(i) Which law explains the usefulness of airbags? (1)
(ii) What happens to acceleration when stopping time increases? (1)
(iii) Why is injury reduced with airbags? (1)
(iv) State one more real-life application based on the same principle. (1)

SECTION E – LONG ANSWER QUESTIONS (5 marks each)

Q25. State and explain Newton's three laws of motion with one suitable real-life example for each law. Also explain why action and reaction forces do not cancel each other.

Q26. A 1200 kg car initially at rest starts moving due to a net force of 2400 N.

(i) Calculate acceleration of the car. (1)

(ii) Find velocity after 10 seconds. (1)

(iii) Calculate displacement in 10 seconds. (2)

(iv) If friction suddenly increases, explain qualitatively how motion will change. (1)

BONUS HOTS QUESTION (Optional)

A spacecraft moving in deep space switches off its engines. Many students think it should immediately stop moving because no force acts on it.

Using Newton's laws, explain why this thinking is incorrect.