Answer key: Speeding Up or Slowing Down? Check a and v

Physics with Tiaotiao 跳跳 · Kinematics · High School Physics
Study sheet for the video "Speeding Up or Slowing Down?": answer key

Answers and explanations

1. C. A is wrong: the rate of change of velocity tells you how fast the velocity changes, not how much. B is wrong: Δv always points the same way as a. C is correct: if the velocity changes, $\Delta v \neq 0$, so $\Delta v / \Delta t \neq 0$. D is wrong: a is defined as $\Delta v / \Delta t$, but a does not depend on Δv or Δt (it depends only on the net force F and the mass m, which comes later), so there is no proportionality.
▶ **Watch 11:40, Example 1**

2. C. v_2 is shorter than v_1, so $\Delta v = v_2 - v_1$ points to the left. The acceleration points the same way as Δv, so it points to the left, opposite to v_1 (which points right). a and v are opposite, so the car is slowing down. That makes C correct; A, B and D are wrong.
▶ **Watch 18:01, Example 2**

3. ① F ② F ③ T ④ F ⑤ F ① F. a = 0 means the velocity does not change: the object is at rest or in uniform straight-line motion. ② F. Δv is large, but a also depends on the time. ③ T. Acceleration is the rate of change of velocity: the same thing. ④ F. A car moving right speeds up (a right), then brakes without stopping (a left): v keeps its direction, a does not. ⑤ F. Δv always points the same way as a, so a keeps its direction. But a is a vector: it is constant only if both magnitude and direction stay the same.
▶ **Watch 19:13, Example 3**

4. C. The sign of a shows only direction, so to compare magnitudes look at the numbers: 4 > 3. Object 2 has the greater acceleration, so its velocity changes faster, and Object 1's changes more slowly (C is correct; D is wrong). A and B are wrong: we do not know the directions of their velocities.
▶ **Watch 21:32, Example 4**

5. B. Xiao Gang says: rising prices = speeding up. So the velocity is increasing. "Rising more slowly" means the velocity increases more and more slowly. So a and v point the same way, but a is decreasing.
▶ **Watch 26:19, Example 5**

6. A. Look only at the directions of a and v. Same direction: speeding up. Opposite: slowing down. A: v east, a west: opposite, slowing down. This can exist, and it does not matter that a grows. B: same direction would mean speeding up, not decreasing. C and D: opposite directions mean slowing down, not increasing.
▶ **Watch 27:48, Example 6**

7. D. A is wrong: a = 0 means at rest or uniform straight-line motion. B and C are wrong: knowing only that a decreases, you cannot tell whether v increases or decreases. D is correct: a describes how fast v changes, so the larger a is, the faster v changes.
▶ **Watch 31:41, Example 7**

8. B. The question asks for the incorrect statement. A is possible (opposite, slowing down). B is incorrect: zero acceleration means constant velocity, which need not be zero. C is possible: Object 1 changes by 10 m/s but $a = 10 / 1000 = 0.01\ m/s^2$; Object 2 changes by only 5 m/s but $a = 5 / 1 = 5\ m/s^2$. D is possible: a and v point the same way while a decreases, so the object keeps speeding up and v gets larger.
▶ **Watch 32:36, Example 8**

9. B. A is wrong: it can also move at constant velocity. B is correct: if a and v point the same way, v increases even while a decreases. C is wrong: if a and v are opposite, v decreases even while a increases. D: the second half is wrong. A rocket just after ignition has v = 0 yet a large acceleration.
▶ **Watch 34:19, Example 9**

10. B. Same direction: the object speeds up, more and more slowly. When a reaches 0 it keeps that velocity, which is the largest it has had. So B is correct and A is wrong. C: the object is still moving forward, so the displacement keeps increasing. D: the velocity never changes direction, so the object never turns around and the displacement keeps increasing.
▶ **Watch 35:53, Example 10**

11. A, C and D. Here "> 0" means pointing in the positive direction. a and v are both positive, so they point the same way: the object speeds up, then moves at constant velocity once a is 0. A is correct: a is getting smaller, so v changes more and more slowly. B is wrong: v does not decrease. C is correct: the object keeps moving in the positive direction. D is correct: s and v stay positive.
▶ **Watch 39:04, Example 11**

12. D. A is wrong: if a and v point the same way, v still increases while a decreases. B is wrong: the change in velocity also depends on the time. C is wrong: with a to the left and v to the right, the object slows down, stops, then moves left: the direction of v changes while a stays the same. D is correct: acceleration describes how quickly the velocity changes.
▶ **Watch 42:20, Example 12**

13. A, B and C. A is possible: a and v opposite, and a reaches 0 before v does. B is possible: a and v in the same direction. C is possible: opposite at first; v reaches 0 while a is not yet 0, then the object speeds up the other way. D is impossible: speeding up means a and v are in the same direction, and when a reaches 0 the velocity stays constant, so it never decreases.
▶ **Watch 43:31, Example 13**

14. A and D. A is correct: a and v opposite, two stages: slow down, then reverse. B is wrong: it depends on which direction you choose as positive. C is wrong: a rocket at the instant of ignition has v = 0 but a large a. D is correct: in uniform acceleration a and v point the same way, so a is positive only if v_0 is.
▶ **Watch 47:12, Example 14**