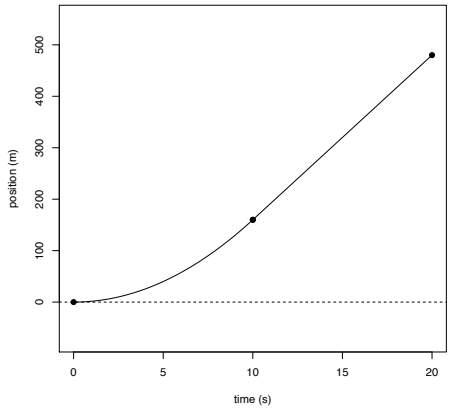
D. A Larger Problem

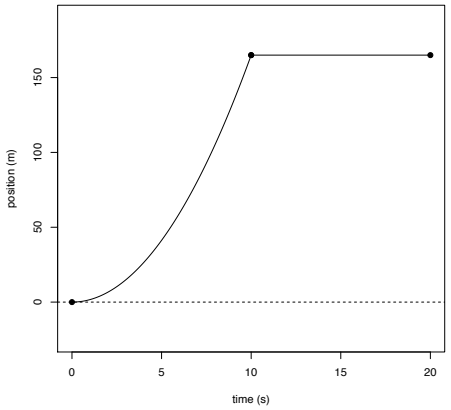
For each story, first, write a description in physics language. Use the terms not moving, constant velocity, positive acceleration, or negative acceleration to describe the motion story.
Then, select a position-time graph, velocity-time graph, acceleration-time graph, and motion map for each story from the following pages.

Story	Position-Time Graph	Velocity-Time Graph	Acceleration-Time Graph	Motion Map
1. A car is waiting at a red light. The light turns green, the driver hits the gas pedal, and the car begins accelerating.				
2. A driver begins at rest and floors the accelerator, but the car slams straight into a brick wall.				
3. A driver accelerates from rest, and after reaching his favorite speed continues driving at a constant velocity.				
4. A traffic light turns green. A driver accelerates from rest to some velocity. He then drives at a constant velocity for a while, but eventually slows back down until he is stopped.				
5. Somebody is sitting on the couch walking TV. Then they get up and go for a walk at a constant velocity.				
6. A car is driving forward at a constant speed when it suddenly hits a wall and stops moving.				

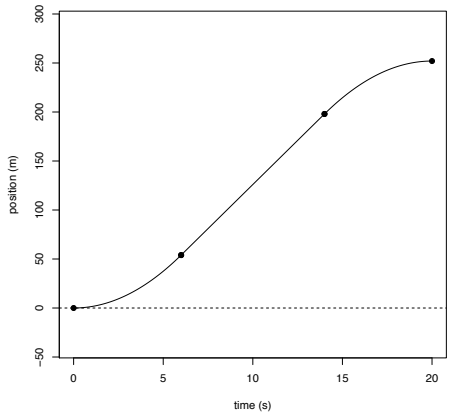
Position graph A



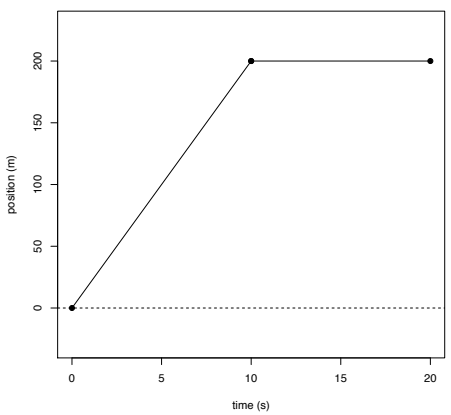
Position graph D



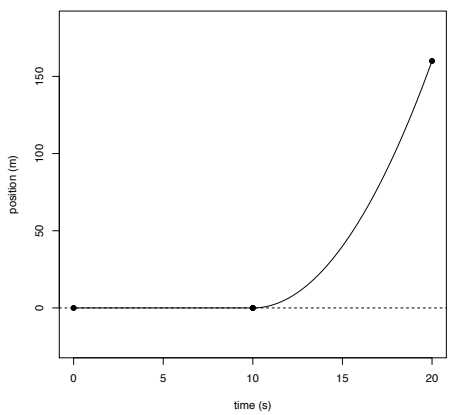
Position graph B



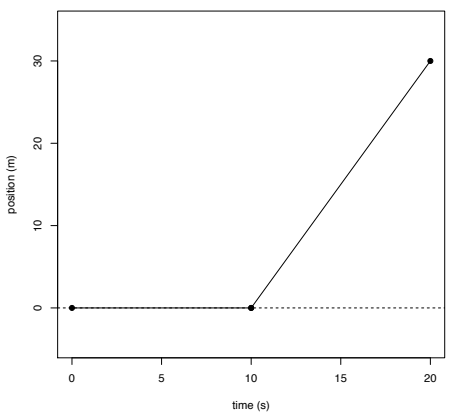
Position graph E



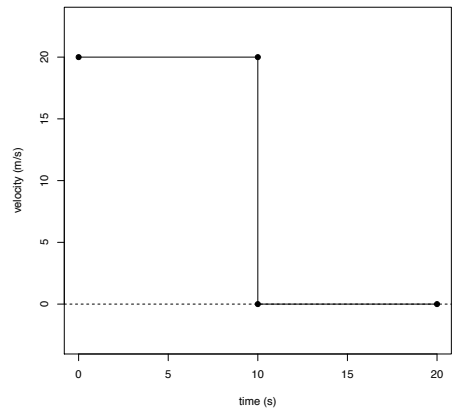
Position graph C



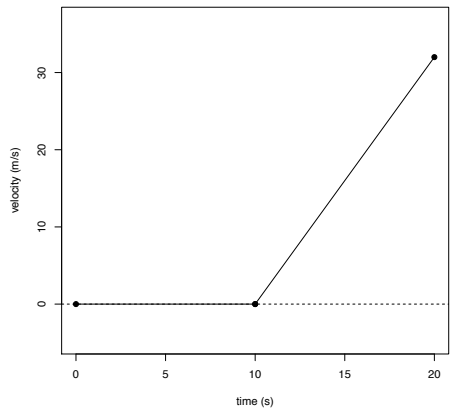
Position graph F



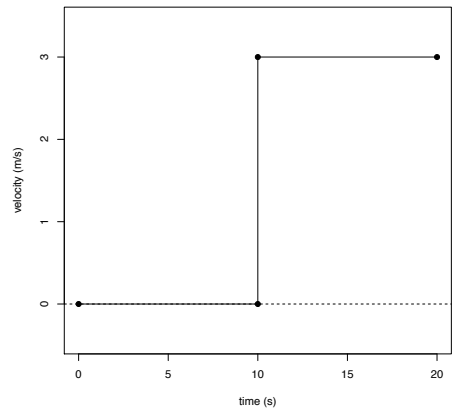
Velocity graph A



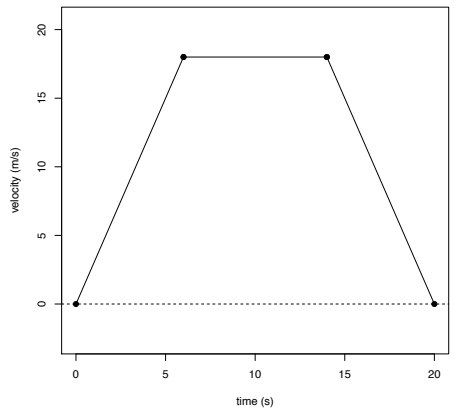
Velocity graph D



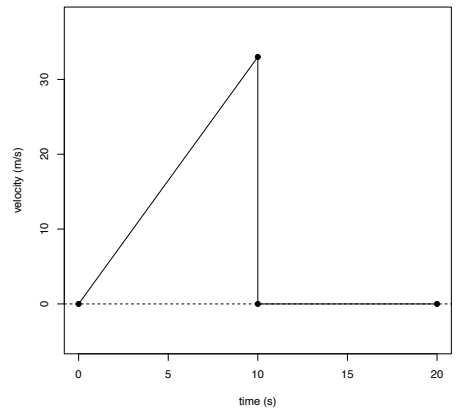
Velocity graph B



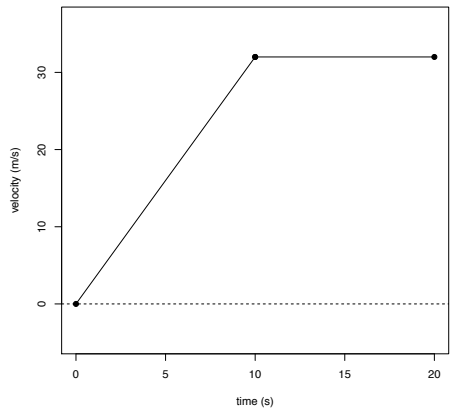
Velocity graph E



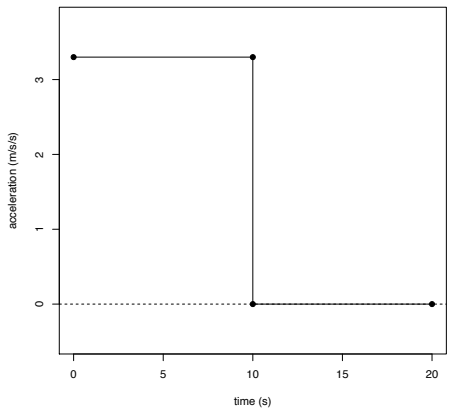
Velocity graph C



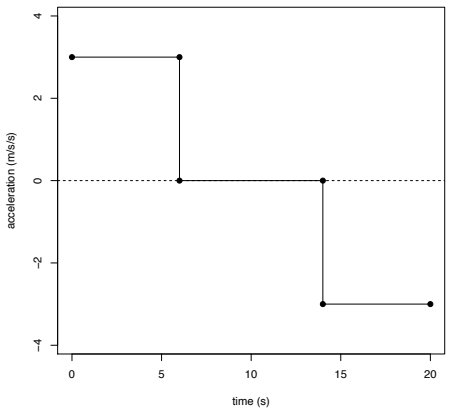
Velocity graph F



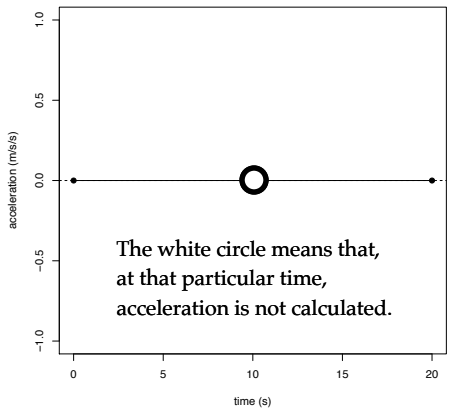
Acceleration graph A



Acceleration graph D

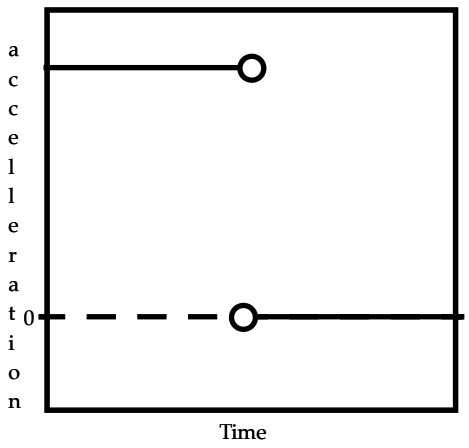


Acceleration graph B

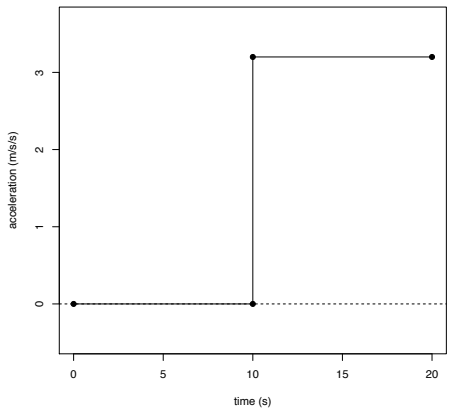


The white circle means that, at that particular time, acceleration is not calculated.

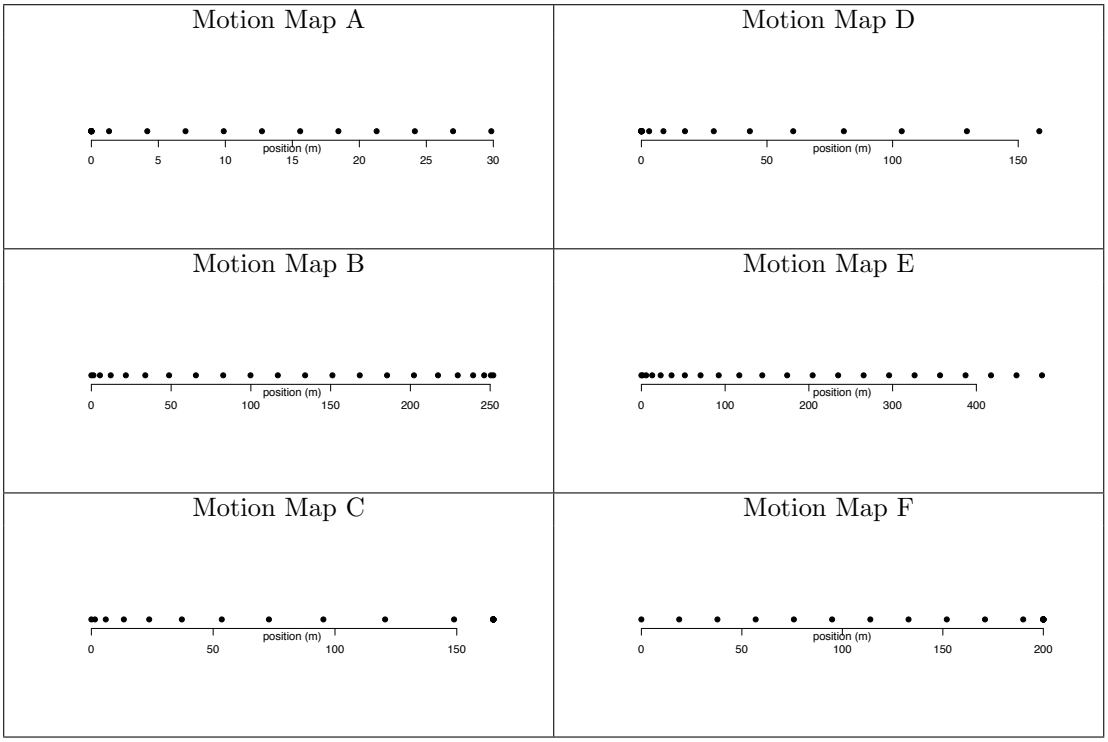
Acceleration graph E



Acceleration graph C



The white circles means that, at that particular time, acceleration is not calculated.


Motion Map A
position (m)
0
5
10
15
20
25
30
Motion Map D
position (m)
0
50
100
150
Motion Map B
position (m)
0
50
100
150
200
250
Motion Map E
position (m)
0
100
200
300
400
Motion Map C
position (m)
0
50
100
150
Motion Map F
position (m)
0
50
100
150
200

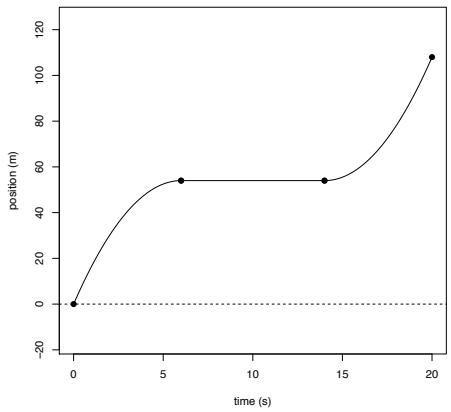
D.1 Answer

Story	Position-Time Graph	Velocity-Time Graph	Acceleration-Time Graph	Motion Map
1. A car is waiting at a red light. The light turns green and the driver hits the gas.	C	D	C	D
2. A driver floors the accelerator and moves forward, but it drives straight into a wall and stops.	D	C	E	C
3.A driver accelerates to a constant velocity and then keeps driving.	A	F	A	E
4. A traffic light turns green, and a driver accelerates from rest until he is driving at a constant velocity. Eventually he slows back down.	B	E	D	B
5. Somebody is sitting on the couch watching TV, then they get up and go for a walk.	F	B	B	A
6. A car is driving forward at a constant speed, then it hits a wall and stops.	E	A	B	F

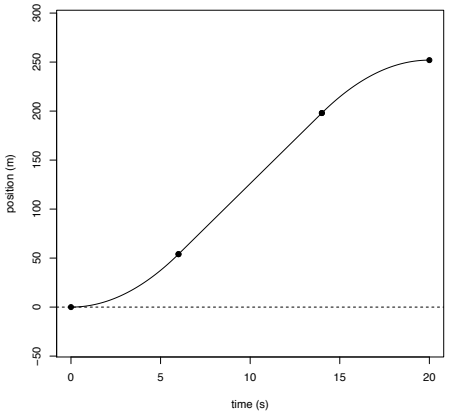
E: Another Large Problem

Story	Position-Time Graph	Velocity-Time Graph	Acceleration-Time Graph	Motion Map
1. A traffic light turns green, and a driver accelerates from rest until he is driving at a constant velocity. Eventually he slows back down to a stop.				
2. A car that is already moving slows down to a stop at a red light. It waits for a time. Then, the light turns green and the driver accelerates again.				
3. Someone is driving on the highway at an unsafe speed, but sees a police car and needs to slow down. He drives past the police car at a constant velocity. After passing the police car, he speeds back up to an unsafe speed.				
4. A driver is moving at a constant speed. A light in front of her turns red, and she begins to slow down. But before she is stopped, it turns green and she speeds back up				
5. A driver is moving at a constant speed. He sees a yellow light and floors his accelerator in order to make it past. After shooting through the intersection, he slows back down to a more normal speed.				

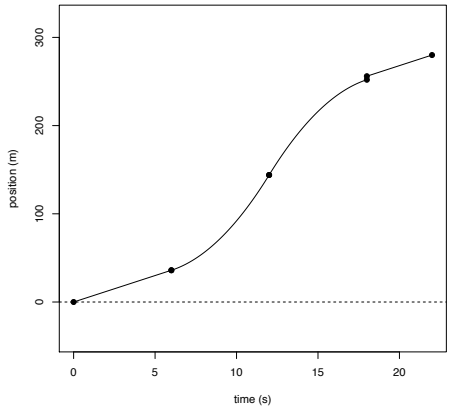
Position graph A



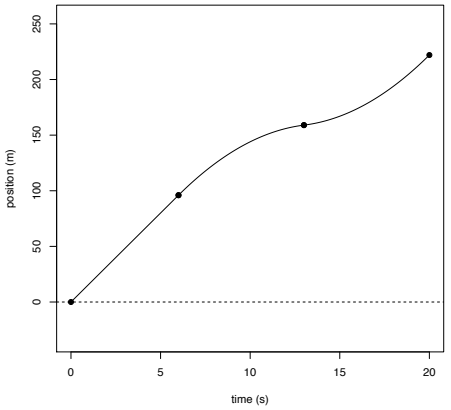
Position graph D



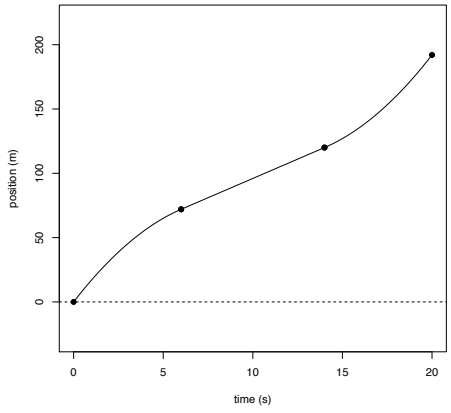
Position graph B



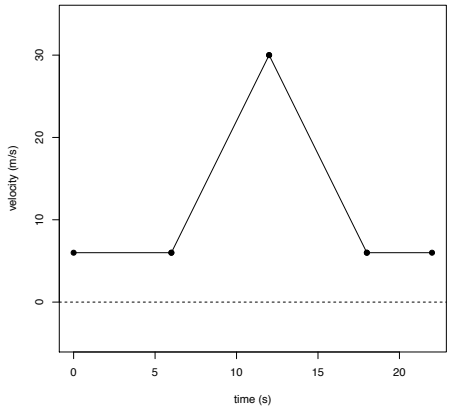
Position graph E



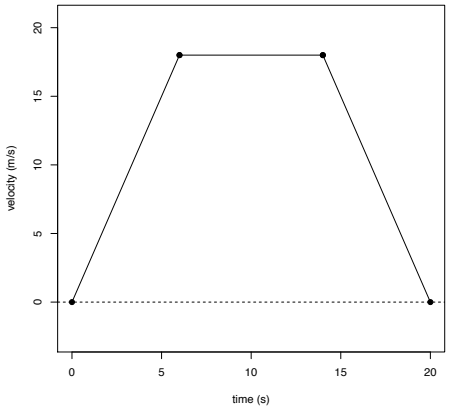
Position graph C



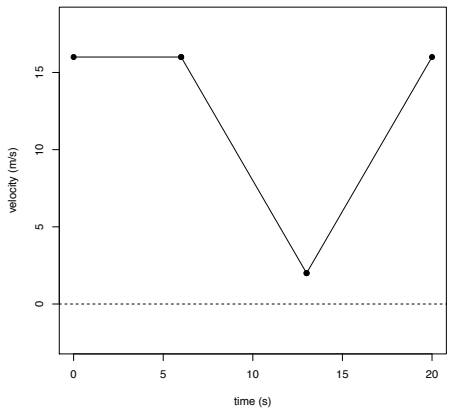
Velocity graph A



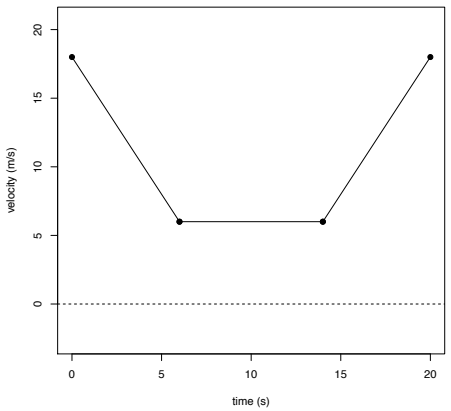
Velocity graph D



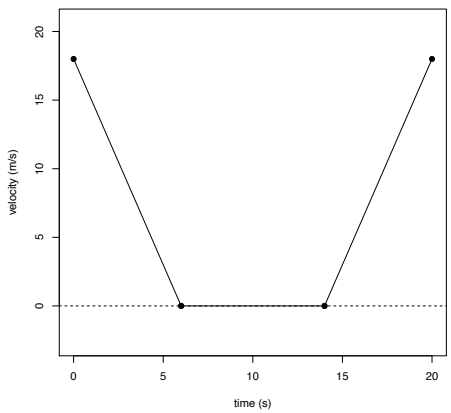
Velocity graph B



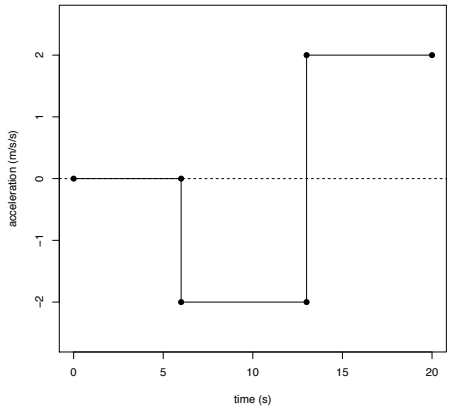
Velocity graph E



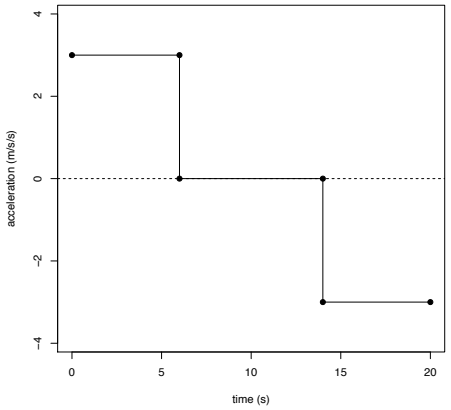
Velocity graph C



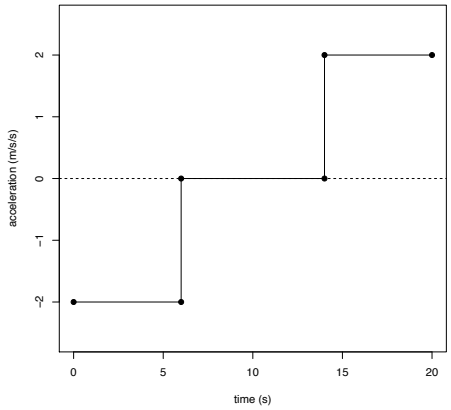
Acceleration graph A



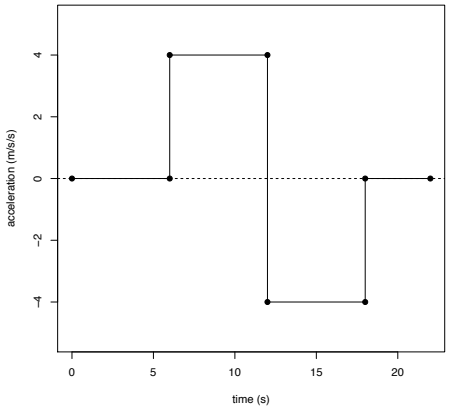
Acceleration graph C



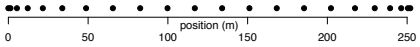
Acceleration graph B



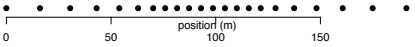
Acceleration graph D



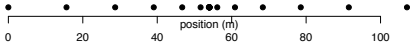
Motion Map A



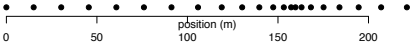
Motion Map D



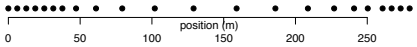
Motion Map B



Motion Map E



Motion Map C



E. Answers

Story	Position-Time Graph	Velocity-Time Graph	Acceleration-Time Graph	Motion Map
1. A traffic light turns green, and a driver accelerates from rest until he is driving at a constant velocity. Eventually he slows back down to a stop.	D	D	C	A
2. A car that is already moving slows down to a stop at a red light. It waits for a time. Then, the light turns green and the driver accelerates again.	A	C	B	E
3. Someone is driving on the highway at an unsafe speed, but sees a police car and needs to slow down. He drives past the police car at a constant velocity. After passing the police car, he speeds back up to an unsafe speed.	C	E	B	D
4. A driver is moving at a constant speed. A light in front of her turns red, and she begins to slow down. But before she is stopped, it turns green and she speeds back up	E	B	A	B
5. A driver is moving at a constant speed. He sees a yellow light and floors his accelerator in order to make it past. After shooting through the intersection, he slows back down to a more normal speed.	B	A	D	C

Facts that people often confuse about these graphs

1.
One car is at rest and starts accelerating.
Another car is already moving and then accelerates at the same rate for the same time.
If you looked at a position-time graph, you could tell the difference.
If you looked at a velocity-time graph, you could tell the difference.
But if you looked at an acceleration-time graph, you wouldn't be able to tell the difference!

2.
One car is moving to the right at a constant speed.
Another car waits for five seconds, then moves to the right at a constant speed.
On a position-time graph or a velocity-time graph, you could tell the difference.
But the motion maps would look the same!
Because the motion map only depicts motion. The five seconds that the car was not moving would not appear on the motion map, only the constant velocity motion.

3.
If your acceleration is zero, you can still be moving!
In fact, if your acceleration graph is zero all the time, you can still be moving the whole time!