

CDL

COMBINATION VEHICLES MASTER COURSE

Complete 7-Chapter Study Guide

Chapter	Topic
Chapter 1	Coupling & Uncoupling — Fifth Wheel, Kingpin, Glad Hands, Landing Gear
Chapter 2	Air Brake Systems — Service Line, Emergency Line, Pressure Thresholds
Chapter 3	Driving Safety — Following Distance, Offtracking, Rollover, Visibility
Chapter 4	Skids & Jackknife Prevention — Types, Recovery, Brake Control
Chapter 5	Inspection Procedures — Coupling, Air Lines, Brake Tests, Fifth Wheel
Chapter 6	Combination Vehicle Theory — Weight Transfer, CG, Stopping Distance
Chapter 7	Hazardous Materials & Placards — Classes, Placement, Safety Rules

Includes: Professional explanations · Step-by-step procedures · Safety rules · Common mistakes
DMV tips · Inspection checklists · Practice questions (70 total) · Quick review sheets

CDL COMBINATION VEHICLES MASTER COURSE

Chapter 1

Coupling & Uncoupling

Fifth Wheel · Kingpin · Glad Hands · Landing Gear · Locking Jaws

Fifth Wheel & Kingpin

Glad Hands

Coupling Procedure

Safety Rules

DMV Tips & Q&A

Section 1 — Key Components

Fifth Wheel

The fifth wheel is the large U-shaped coupling plate on the rear of the tractor. It acts as the pivot point and must be greased at all times. The throat receives the kingpin. The fifth wheel tilts downward at the rear to guide coupling.

Kingpin

A hardened steel pin mounted under the trailer front. Fits into the fifth wheel throat and is secured by locking jaws. Must be straight and undamaged — a damaged kingpin is a critical defect.

Glad Hands

- **Emergency Line (RED):** Supplies air to trailer reservoir. Loss of pressure = spring brakes apply automatically.
- **Service Line (BLUE):** Carries air for normal brake applications. Connect RED first, then BLUE.

Glad hands use a 90-degree twist-lock. Sealing gaskets must be intact.

Landing Gear

Retractable support legs beneath the trailer. Must be FULLY raised before driving. Low gear for heavy loads, high gear for light loads. Partial extension = road contact = catastrophe.

Locking Jaws

Internal fifth wheel mechanism that captures the kingpin. After coupling the safety latch engages — the release handle CANNOT be pulled. This is correct behavior, not a malfunction.

Section 2 — Coupling Procedure (14 Steps)

1. Inspect fifth wheel: damage, lubrication, jaws open, handle in auto-lock.
2. Position tractor directly in front of trailer — centered, not at angle.
3. Adjust trailer height: nose slightly LOWER than rear of fifth wheel.

4. Back slowly toward the trailer watching both mirrors.
5. Stop when fifth wheel contacts the trailer apron — do not ram.
6. Apply tractor parking brakes.
7. Verify trailer height once more.
8. Connect emergency (RED) glad hand first, then service (BLUE).
9. Push in trailer air supply valve to supply air to trailer.
10. Chock trailer wheels if movement risk exists.
11. Back slowly under trailer until locking jaws engage the kingpin.
12. Raise landing gear FULLY. Use low gear then switch to high as weight lifts.
13. Connect electrical cord and test trailer lights.
14. Perform tug test and visually inspect fifth wheel from underneath.

Section 3 — Uncoupling Procedure (9 Steps)

1. Park on firm, level ground.
2. Apply trailer brakes with the hand valve.
3. Ease forward slightly to release tension on the kingpin.
4. Apply tractor parking brakes.
5. Lower landing gear until it supports the trailer weight.
6. Disconnect electrical cord. Disconnect service (BLUE) line, then emergency (RED).
7. Pull fifth wheel release handle to unlock jaws.
8. Ease tractor forward until fifth wheel clears kingpin.
9. Inspect area before driving away.

CRITICAL SAFETY RULES — CHAPTER 1

Never couple at an angle — kingpin damage and insecure coupling.

Never drive with landing gear partially extended — road contact is catastrophic.

Always perform the tug test — never assume coupling is locked.

Never cross-connect glad hands — can lock or disable trailer brakes entirely.

Red to red, blue to blue — always verify both connections.

Section 4 — DMV Tips & Memory Tricks

- "Red = Emergency = Stop" — red glad hand controls emergency brakes.
- "Low before you go" — trailer nose slightly LOW before backing under.
- "Tug before you shrug" — always tug test before assuming locked.
- Safety latch engaged = release handle CANNOT be pulled = CORRECT.

- Landing gear must be **FULLY** raised — not mostly raised, fully raised.

Section 5 — Practice Questions

Q1. What color is the emergency glad hand?

- A. Blue
- B. Green
- C. Red**
- D. Yellow

Answer: C. *The emergency (red) glad hand connects to the trailer emergency brake system. Red = Emergency.*

Q2. Before coupling, the trailer nose should be:

- A. Level with the fifth wheel
- B. Slightly higher
- C. Slightly lower than the fifth wheel**
- D. Height does not matter

Answer: C. *The nose must be slightly below the rear of the fifth wheel so the tractor can back under smoothly.*

Q3. What is the purpose of the tug test?

- A. Check air pressure
- B. Confirm the kingpin is locked in the fifth wheel**
- C. Test trailer brakes
- D. Check landing gear

Answer: B. *The tug test confirms the locking jaws have captured the kingpin.*

Q4. After coupling, the release handle cannot be pulled. This means:

- A. The coupling failed
- B. This is CORRECT — the safety latch is engaged**
- C. Back under the trailer again
- D. Disconnect air lines and retry

Answer: B. *The safety latch prevents accidental release. Not being able to pull it is CORRECT.*

Section 6 — Quick Review

Term / Concept	Key Fact
Emergency glad hand	RED — emergency/spring brakes
Service glad hand	BLUE — normal braking
Trailer nose height	Slightly LOWER than rear of fifth wheel

Tug test	Trailer brakes SET, pull in LOW GEAR — must not move
Landing gear	FULLY raised before driving
Coupling order	Emergency (red) first, then service (blue)
Safety latch	Cannot pull release handle = correctly coupled
Uncoupling surface	Firm, level ground only

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Chapter 2

Air Brake Systems

Service Line · Emergency Line · Trailer Supply Valve · Tractor Protection Valve

Service & Emergency
Lines

Pressure Thresholds

Leakage Tests

Valves & Components

DMV Tips & Q&A

Section 1 — How the Air Brake System Works

Air brakes use compressed air to apply stopping force. The engine-driven compressor maintains pressure in storage reservoirs. When the brake pedal is pressed, air is released to brake chambers at each wheel. In combination vehicles, the tractor supplies air to the trailer through two lines: the service line and the emergency line.

Service Line (Blue)

Carries controlled air from the brake pedal to trailer service brake chambers. Active only during normal brake applications. Does NOT hold the trailer at rest.

Emergency Line (Red)

Continuously supplies air to the trailer reservoir — keeping spring brakes released. If pressure drops (trailer breakaway), spring brakes apply automatically.

Trailer Supply Valve (Red Octagonal Button — Dashboard)

Push IN = air to trailer. Pull OUT = cuts air, applies spring brakes. Pops out automatically at 20-45 PSI to protect tractor air supply.

Tractor Protection Valve

Automatic safety device. Closes at 20-45 PSI to isolate tractor air from trailer. Ensures tractor retains braking ability if trailer loses air.

Trailer Hand Valve (Trolley Valve — Steering Column)

Applies trailer brakes independently. Use ONLY during coupling/uncoupling. NEVER for parking or highway braking — can cause jackknife.

Section 2 — Critical Pressure Numbers

Pressure Level	PSI / Action
Low-pressure warning activates	60 PSI or below

Spring brakes apply automatically	20–45 PSI
Normal operating range	100–125 PSI
Governor cut-in	~100 PSI (compressor starts)
Governor cut-out	~125 PSI (compressor stops)
Safety relief valve opens	150 PSI
Max leakage — single vehicle	3 PSI per minute
Max leakage — combination	4 PSI per minute

Section 3 — Required Air Brake Tests

Test 1 — Air Leakage Rate

Build to 125 PSI, engine off, release parking brakes, time 1 minute. PASS: combination loses no more than 4 PSI/min.

Test 2 — Low Pressure Warning

Fan brakes with engine off. PASS: warning buzzer/light activates BEFORE 60 PSI.

Test 3 — Spring Brake

Continue fanning past warning. PASS: spring brakes apply between 20-45 PSI.

Test 4 — Tractor Protection Valve

Fan trailer air with hand valve. PASS: trailer supply button pops out at 20-45 PSI.

SAFETY RULES — CHAPTER 2

Never drive when low-pressure warning activates.

Never use hand valve as parking brake — spring brakes required.

Never apply hand valve during a turn or at highway speed — jackknife risk.

Drain air tanks daily — water and oil accumulate and can freeze.

Red to emergency port, blue to service port — always verify.

Section 4 — DMV Tips & Memory Tricks

- "60 = Warning, 20-45 = Stop" — warning at 60, spring brakes lock at 20-45.
- "3 solo, 4 combined" — leakage limits match vehicle count.
- "Red button = trailer air on/off" — push IN supplies air, pull OUT cuts it.
- "Emergency line keeps spring brakes OFF" — lose the line, brakes apply.

Section 5 — Practice Questions

Q1. At what PSI does the low-pressure warning activate?

- A. 45 PSI
- B. 60 PSI**
- C. 80 PSI
- D. 100 PSI

Answer: B. *The warning must activate at or before 60 PSI.*

Q2. Maximum leakage for a combination vehicle?

- A. 2 PSI/min
- B. 3 PSI/min
- C. 4 PSI/min**
- D. 5 PSI/min

Answer: C. *Combination vehicles: max 4 PSI per minute.*

Q3. What does the emergency line do?

- A. Applies trailer service brakes
- B. Supplies trailer reservoir and triggers emergency brakes if lost**
- C. Controls the hand valve
- D. Pressurizes tractor chambers

Answer: B. *Keeps trailer reservoir charged. Loss of pressure = spring brakes apply.*

Q4. The hand valve should be used for:

- A. Parking on a grade
- B. Normal highway braking
- C. Coupling and uncoupling only**
- D. Increasing brake force

Answer: C. *Hand valve for coupling/uncoupling only. Never for parking or normal braking.*

Section 6 — Quick Review

Term / Concept	Key Fact
Service line	BLUE — normal trailer brake application
Emergency line	RED — supplies reservoir, triggers spring brakes if lost
Low-pressure warning	60 PSI or below
Spring brakes apply	20–45 PSI automatically
Normal operating range	100–125 PSI
Safety valve opens	150 PSI

Leakage — single	Max 3 PSI per minute
Leakage — combination	Max 4 PSI per minute
Hand valve use	Coupling/uncoupling ONLY
Tank draining	Daily — removes water and oil

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Chapter 3

Driving Safety

Following Distance · Offtracking · Curves & Rollover · Visibility · Speed · Lane Control

Following Distance

Offtracking

Rollover Prevention

Visibility & Mirrors

Speed & Lanes

Section 1 — Following Distance

Formula: 1 second per 10 feet of vehicle length at speeds under 40 mph. Above 40 mph: add 1 extra second. Adverse conditions (rain, ice, fog): double the entire following distance.

Vehicle & Speed	Required Distance
40 ft at 35 mph (under 40)	4 seconds
40 ft at 55 mph (over 40)	5 seconds
60 ft at 35 mph (under 40)	6 seconds
60 ft at 55 mph (over 40)	7 seconds
Any vehicle on ice or fog	Double the entire following distance

Section 2 — Offtracking

Offtracking: rear wheels follow a shorter inner path than front wheels in turns. Longer vehicle = greater offtracking. Rear tires can strike curbs, pedestrians, or cyclists without warning.

- Turn wide — steer out before turning so rear wheels clear the curb.
- Button hook: drive past the intersection slightly, then turn right.
- Jug handle: swing left within lane before turning right — signal early to warn following drivers.
- Never start a right turn from the middle lane — dangerous and illegal.

Section 3 — Rollover Prevention

ROLLOVER — #1 FATAL CRASH TYPE FOR COMBINATION VEHICLES

Cause #1: Excessive speed in curves or ramps — most common cause.

Cause #2: High or shifting cargo — raises center of gravity.

Cause #3: Partial liquid loads that slosh during turns.

Cause #4: Sudden steering corrections at speed — can tip trailer instantly.

Rule: Slow down BEFORE the curve — never brake inside the turn.

Posted ramp/curve speed is for passenger cars — take it 5-10 mph slower in a truck.

The trailer rolls BEFORE the tractor — prevention is the only option.

Crack the whip: Rear of trailer moves faster and farther than the tractor during sudden swerves. Can roll the trailer while the tractor stays upright.

Section 4 — Visibility & Blind Spots

Blind Spot	Size / Risk
Behind trailer	200+ feet — largest blind spot
Right side	Full trailer length + one full lane right — largest SIDE blind spot
Left side	Full trailer length — smaller than right
Directly in front	20 feet from front bumper

Convex mirrors: wider view but objects appear FARTHER than they are. Never judge distance from convex mirrors alone.

Section 5 — Speed Management & Downhill Grades

- Stopping distance at 55 mph (loaded combination): 400+ feet.
- Select downhill gear at the TOP of the grade — before descending.
- Never ride brakes continuously downhill — brake fade results.
- Controlled braking: apply firmly to drop 5 mph below target, release, repeat.

Brake fade: heat from sustained braking. Once faded, no recovery while moving. Only remedy: stop and cool completely.

Section 6 — Practice Questions

Q1. Minimum following distance for a 60-ft combo at 55 mph?

- A. 5 seconds
- B. 6 seconds
- C. 7 seconds**

D. 8 seconds

Answer: C. 60 ft = 6 sec base. Above 40 mph add 1 second = 7 seconds total.

Q2. What is offtracking?

A. Tractor sliding sideways

B. Rear wheels following shorter path than front wheels in a turn

C. Trailer swinging during braking

D. Front wheels losing traction

Answer: B. Offtracking: rear wheels track inside front wheel path in turns.

Q3. Most common cause of rollover?

A. Tire blowout

B. Brake failure

C. Excessive speed in curves or ramps

D. Improper coupling

Answer: C. Speed in curves/ramps is the #1 cause. High CG makes loaded trailers very sensitive.

Q4. Brake fade is caused by:

A. Worn brake pads

B. Air pressure loss

C. Heat from prolonged downhill braking

D. Ice on brake drums

Answer: C. Brake fade = heat from sustained downhill braking. Stop and cool — no in-motion recovery.

Section 7 — Quick Review

Term / Concept	Key Fact
Following distance	1 sec per 10 ft + 1 sec over 40 mph
Rear blind spot	200+ feet behind trailer
Front blind spot	20 feet from bumper
Rollover cause #1	Excessive speed in curves/ramps
Posted curve speed	5-10 mph below limit for trucks
Stopping at 55 mph	400+ feet (loaded combination)
Offtracking	Rear wheels cut inside front wheel path
Brake fade	Heat from sustained braking — stop to recover
Downhill gear	Select at the TOP before descending
Crack the whip	Trailer rolls during sudden swerve at speed

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Chapter 4

Skids & Jackknife Prevention

Trailer Skids · Drive Axle Skids · Brake Control · Recovery Procedures

Types of Skids

Jackknife Causes

Recovery Steps

Brake Control

DMV Tips & Q&A

Section 1 — Types of Skids

Trailer Skid — Most Dangerous

Trailer rear swings sideways pushing the tractor. Cause: trailer brakes lock up. FIRST action: release trailer brakes immediately via the hand valve. Do NOT add more brake.

Drive Axle Skid — Leads to Jackknife

Tractor drive wheels lock up. Rear of tractor swings outward. Cause: over-braking. FIRST action: release ALL brakes immediately.

Front Wheel Skid

Steering wheels lose traction — vehicle goes straight regardless of steering. Cause: over-braking front wheels. Recovery: release brakes, let wheels roll, steer gently.

Acceleration Skid

Drive wheels spin from too much power on slippery surface. Recovery: ease off throttle gently — do not abruptly release.

Section 2 — Jackknife: Causes & Development

A jackknife occurs when the tractor and trailer fold toward each other at the fifth wheel.

Tractor jackknife: drive wheels lock, tractor rear swings outward (most common). Trailer jackknife: trailer wheels lock, trailer swings wide.

1. Brakes applied hard on slippery surface.
2. Drive wheels lock — lose lateral grip.
3. Rear of tractor slides sideways.
4. Trailer pushes tractor rear outward.
5. Angle increases rapidly — jackknife underway.
6. At ~45 degrees, unrecoverable — combination overturns.

Section 3 — Recovery Procedures

Trailer Skid Recovery

- Step 1: Release trailer brakes via the hand valve immediately.
- Step 2: Do NOT apply more brake pressure.
- Step 3: Countersteer gently to control tractor direction.
- Step 4: Reapply brakes smoothly once traction returns.

Drive Axle Skid Recovery

- Step 1: Release ALL brakes immediately.
- Step 2: Countersteer in the direction the rear is sliding.
- Step 3: Gently reapply brakes once grip returns.
- Do NOT overcorrect — swings trailer to opposite side creating a new skid.

NEVER DO THESE DURING A SKID

Never apply more brake pressure — worsens every skid type.

Never overcorrect steering — swings trailer to opposite side.

Never accelerate during a skid.

Never panic-steer — smooth inputs only.

Section 4 — Brake Control Techniques

Threshold Braking (Non-ABS)

Apply maximum brake force just below wheel lockup point. Keeps wheels rolling, maintains steering. If wheels begin to lock, ease off slightly then reapply.

ABS — Anti-Lock Braking System

Apply firm continuous pressure and STEER — do NOT pump. ABS prevents wheel lockup but NOT rollover. Tractor ABS controls only tractor wheels — trailer may have separate ABS.

Stab Braking (Non-ABS Emergency Only)

Full brake to near-lockup, release completely, reapply. Cycle ~once per second. Non-ABS ONLY.

Section 5 — Practice Questions

Q1. Most common cause of jackknife?

- A. Tire blowout

B. Drive axle lockup from over-braking

- C. Trailer brake failure
- D. Steering seizure

Answer: B. Drive axle lockup from over-braking is the #1 jackknife cause.

Q2. First action in a trailer skid?

- A. Apply more brakes
- B. Accelerate

C. Release the trailer brakes

- D. Countersteer sharply

Answer: C. Release trailer brakes FIRST — adding pressure worsens the skid.

Q3. First action in a drive axle skid?

- A. Apply hand valve
- B. Release all brakes**
- C. Steer sharply opposite
- D. Downshift

Answer: B. Release ALL brakes immediately to allow wheels to roll and regain traction.

Q4. ABS prevents:

- A. Rollover
- B. Wheel lockup during braking**
- C. Brake fade
- D. All skids

Answer: B. ABS prevents wheel lockup only. Does NOT prevent rollover or brake fade.

Section 6 — Quick Review

Term / Concept	Key Fact
Jackknife cause #1	Drive axle lockup from over-braking
Trailer skid — first action	Release trailer brakes immediately
Drive axle skid — first action	Release ALL brakes immediately
ABS technique	Firm steady pressure + steer — do NOT pump
Stab braking	Non-ABS vehicles ONLY
ABS prevents	Wheel lockup — NOT rollover
Tractor jackknife	Drive wheels lock, tractor rear swings out
During any skid	NEVER add more brake pressure
Overcorrecting risk	Trailer swings opposite side — new skid

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Chapter 5

Inspection Procedures

Coupling · Air Lines · Trailer Brake Testing · Fifth Wheel · Landing Gear

Pre-Trip Overview

Coupling Inspection

Air Line Checks

Brake Tests

DMV Tips & Q&A

Section 1 — Why Inspections Matter

Pre-trip inspection is legally required before every trip. The driver is always responsible — not the mechanic or company. Failing to find a defect makes the driver liable for any resulting crash or violation.

For combination vehicles, inspect: tractor, trailer, AND the connection — fifth wheel, kingpin, air lines, glad hands, landing gear.

Section 2 — Coupling Inspection Checklist

- Fifth wheel plate properly greased — no dry areas.
- Locking jaws FULLY closed around kingpin shank — viewed from underneath.
- Safety latch engaged — release handle cannot be pulled (correct behavior).
- No gap between upper and lower fifth wheel plates.
- Kingpin straight and undamaged — no bends or cracks.
- Trailer apron resting fully on fifth wheel — no tilt.
- Tug test completed and passed — vehicle did not move.
- Fifth wheel mounting bolts present, tight, and undamaged.

Section 3 — Air Line & Glad Hand Inspection

- Emergency (RED) connected to red port — 90 degree twist-lock confirmed.
- Service (BLUE) connected to blue port — 90 degree twist-lock confirmed.
- Sealing gaskets present and undamaged in both glad hands.
- No audible air leaks from connections after pressurizing.
- Air lines not kinked, chafed, or rubbing against sharp edges or moving parts.
- Trailer supply valve pushed IN — supplying air to the trailer.

Section 4 — Required Air Brake Tests

Test 1 — Air Leakage Rate

Build to 125 PSI, engine off, release parking brakes, time 1 minute. PASS: combination max 4 PSI/min.

Test 2 — Low Pressure Warning

Fan brakes with engine off. PASS: warning activates BEFORE 60 PSI.

Test 3 — Spring Brake

Continue fanning. PASS: spring brakes apply between 20-45 PSI.

Test 4 — Tractor Protection Valve

Fan trailer air with hand valve. PASS: supply button pops out at 20-45 PSI.

Test 5 — Trailer Brake

Apply hand valve, pull forward slowly. PASS: resistance confirms trailer brakes applying.

Section 5 — Fifth Wheel & Landing Gear

Fifth Wheel — Before Coupling

- Mounted securely — no loose or missing bolts.
- Plate lubricated adequately — no dry spots.
- Jaws OPEN, release handle in auto-lock position.
- No cracks or deformation on plate or bracket.

Landing Gear

- FULLY raised (retracted) — crank handle secured in bracket.
- Legs not bent, cracked, or damaged.
- Cross brace (if equipped) intact and secured.

Section 6 — DMV Tips

- Say each item aloud as you check it — examiner grades both verbal and physical checks.
- Must physically look underneath to verify locking jaws around kingpin shank.
- Tug test must be performed AND verbalized during the skills test.
- Slack adjusters: less than 1 inch of movement = properly adjusted.
- "Look up, lock confirmed" — check fifth wheel jaws from underneath.
- "Red to red, blue to blue" — say it aloud every time you connect glad hands.

Section 7 — Practice Questions

Q1. Who is responsible for the pre-trip inspection?

- A. The mechanic
- B. The dispatcher
- C. The driver**
- D. The company safety officer

Answer: C. *The driver is always responsible for the pre-trip inspection.*

Q2. How do you verify locking jaws are closed after coupling?

- A. Pull the release handle
- B. Look from underneath at the fifth wheel**
- C. Check from inside the cab
- D. Listen for a click

Answer: B. *Must physically look from underneath to verify jaws are closed around kingpin shank.*

Q3. Maximum leakage for a combination during inspection?

- A. 2 PSI/min
- B. 3 PSI/min
- C. 4 PSI/min**
- D. 5 PSI/min

Answer: C. *Combination vehicle maximum is 4 PSI per minute.*

Q4. Slack adjusters should have:

- A. No movement at all
- B. Less than 1 inch of movement**
- C. Less than 2 inches
- D. Less than 3 inches

Answer: B. *Less than 1 inch of movement confirms proper brake adjustment.*

Section 8 — Quick Review

Term / Concept	Key Fact
Inspection required	Before every trip — driver responsible
Coupling check	From underneath — verify jaws around kingpin shank
Tug test	Trailer brakes set, pull in low gear — no movement = pass
Leakage — combination	Max 4 PSI per minute
Warning test	Activates at or before 60 PSI
Spring brake test	Applies at 20-45 PSI
Landing gear	Fully raised, crank secured
Glad hands	Red to red, blue to blue — gaskets undamaged

Safety latch	Cannot pull release handle = correctly coupled
Slack adjusters	Less than 1 inch movement = properly adjusted

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Chapter 6

Combination Vehicle Theory

Weight Transfer · Center of Gravity · Trailer Swing · Stopping Distance · Air Flow

Weight Transfer

Center of Gravity

Trailer Swing

Stopping Distance

Air Flow Systems

Section 1 — Weight Transfer

Weight transfer occurs during braking, acceleration, and turning. During braking, weight shifts forward — increasing front axle load and reducing rear axle traction, increasing skid risk. During turning, lateral weight transfer increases rollover risk.

- **Hard braking shifts weight forward — rear wheels lose traction, skid risk increases.**
- **Gradual braking minimizes weight transfer and keeps all wheels in traction.**
- **Empty trailers can be more dangerous in crosswinds due to light weight and high profile.**

Section 2 — Center of Gravity

The center of gravity (CG) is the balance point of all vehicle weight. Higher CG = more likely to roll over in curves. Loaded tankers and high-cube trailers have very high CGs.

- **Load cargo as LOW as possible to lower the center of gravity.**
- **Distribute weight evenly side to side.**
- **Partial liquid tanks: liquid sloshes, creating a HIGHER effective CG and unpredictable handling.**

Section 3 — Trailer Swing

Trailer swing (rear-end swing) is the sideways movement of the trailer rear during tight turns or lane changes. The rear of a long trailer can sweep a wide arc, striking vehicles or pedestrians in the adjacent lane.

- **During a right turn, trailer rear can strike vehicles passing on the right.**
- **Always check right-side mirrors throughout any turn to monitor trailer sweep.**

Section 4 — Stopping Distance

Total stopping distance = perception + reaction + braking distance. A loaded combination at 55 mph needs 400+ feet. Stopping distance increases with the SQUARE of speed (double speed = 4x distance).

Condition	Stopping Distance Impact
55 mph, dry road (loaded combo)	400+ feet
Wet road	Increase by 25-50%
Ice or snow	May be 4-10x normal distance
Speed doubled	Stopping distance increases 4x

Section 5 — Air Flow Systems

Air flows from the compressor through the supply (wet) tank to both tractor and trailer systems. Governor controls compressor cycling (cut-in ~100 PSI, cut-out ~125 PSI). Safety valve opens at 150 PSI if governor fails. Air dryers remove moisture to prevent freezing.

- Compressor to supply tank to service tank to delivery valves to brake chambers.
- Also: supply tank to emergency line to trailer reservoir to trailer brake chambers.

Section 6 — Practice Questions

Q1. What happens to weight distribution during hard braking?

- A. Weight shifts rearward
- B. Weight shifts forward to the front axle**
- C. Distribution does not change
- D. Weight shifts left

Answer: B. *During braking, weight transfers forward, increasing front load and reducing rear traction.*

Q2. Why is a partially filled liquid tanker more dangerous than a full one?

- A. It is lighter and stops faster
- B. Liquid sloshes, raising effective CG and destabilizing the vehicle**
- C. It has less air pressure
- D. Kingpin is under less load

Answer: B. *Partial loads slosh, raising CG and creating an unpredictable shifting center of gravity.*

Q3. Stopping distance increases with speed at what rate?

- A. Linearly — double speed = double distance
- B. Logarithmically
- C. With the square — double speed = 4x distance**
- D. Randomly

Answer: C. *Stopping distance increases with the square of speed. Double speed = 4x the stopping distance.*

Q4. Where should cargo be loaded to reduce rollover risk?

- A. As high as possible
- B. As low as possible and evenly distributed**
- C. Concentrated on one side
- D. On the rear axle only

Answer: B. *Load as low as possible to minimize center of gravity and reduce rollover risk.*

Section 7 — Quick Review

Term / Concept	Key Fact
Weight transfer — braking	Forward — front gains load, rear loses traction
Center of gravity	Lower = more stable — load cargo low
Liquid loads	Partially filled MORE dangerous — liquid sloshes
Stopping at 55 mph	400+ feet for loaded combination
Speed and stopping	Double speed = 4x stopping distance
Trailer swing	Rear sweeps wide — monitor right mirror in turns
Air flow	Compressor to tanks to delivery valves to brake chambers

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Chapter 7

Hazardous Materials & Placards

Placard Visibility · Mounting Requirements · HazMat Safety Rules · Combination Procedures

Placard Requirements

HazMat Classes

Safety Rules

Combination
Procedures

DMV Tips & Q&A

Section 1 — What Are Placards?

Placards are diamond-shaped warning signs placed on all four sides of a combination vehicle to identify hazardous materials being transported. They allow emergency responders to quickly identify dangers during an accident.

Federal law (49 CFR) requires specific placards based on material type, class, and quantity. The driver must understand when placards are required and how to display them correctly.

Section 2 — When Placards Are Required

Quantity / Material	Placard Requirement
1,001 lbs or more (Table 2 materials)	Placards REQUIRED
Any amount of Table 1 materials	Placards REQUIRED — regardless of quantity
Less than 1,001 lbs (Table 2)	Placards NOT required (but may be used)
Infectious substances — any amount	Always requires placard
Radioactive materials (certain categories)	Always requires placard

Section 3 — Placard Placement Requirements

Placards must be on ALL FOUR sides of the vehicle: front, rear, left side, and right side. Each placard must be:

- Readable from a minimum of 30 feet away.
- At least 250 square inches (10.8 inches on each side of the diamond).
- Positioned right-side up and legible — not upside down.
- Not obscured by dirt, damage, or other markings.

Section 4 — The 9 Hazard Classes

Class	Hazard Type
Class 1	Explosives (divisions 1.1 through 1.6)
Class 2	Gases (flammable, non-flammable, toxic)
Class 3	Flammable and combustible liquids
Class 4	Flammable solids, spontaneous combustibles, dangerous when wet
Class 5	Oxidizers and organic peroxides
Class 6	Poison/toxic and infectious substances
Class 7	Radioactive materials
Class 8	Corrosives
Class 9	Miscellaneous dangerous goods

Section 5 — HazMat Safety Rules

CRITICAL HAZMAT SAFETY RULES

Never transport HazMat without proper shipping papers, placards, and emergency response information.

Never park a placarded vehicle within 300 feet of a bridge, tunnel, or building without authorization.

Never smoke within 25 feet of a placarded vehicle carrying flammable materials.

Always carry the Emergency Response Guidebook (ERG) when transporting HazMat.

If you discover a leak or spill — stop safely, stay upwind, and call for emergency help.

Shipping papers must be within reach of the driver seat or in the door pocket at all times.

Section 6 — Shipping Papers

Shipping papers (bill of lading/manifest) must accompany every HazMat shipment. Required information:

- Proper shipping name (not a trade name).
- Hazard class and division number.
- UN/NA identification number (4-digit number).
- Packing group (I, II, or III — indicates danger level).
- Total quantity and units.
- Emergency response telephone number — available 24 hours a day.

Section 7 — DMV Tips

- Placards go on ALL FOUR sides — front, rear, left, right.
- Must be readable from 30 feet — not obstructed or damaged.
- Table 1 = placard always, any quantity. Table 2 = placard at 1,001 lbs or more.
- Shipping papers must be within reach of driver seat or in door pocket.
- Never park within 300 feet of a bridge, tunnel, or building when placarded.
- No smoking within 25 feet of flammable HazMat.

Section 8 — Practice Questions

Q1. On how many sides must placards be displayed?

- A. One (rear only)
- B. Two (front and rear)
- C. Three
- D. Four (front, rear, and both sides)**

Answer: D. *Placards must be on all four sides: front, rear, left side, and right side.*

Q2. From what minimum distance must a placard be readable?

- A. 10 feet
- B. 20 feet
- C. 30 feet**
- D. 50 feet

Answer: C. *Placards must be readable from at least 30 feet away.*

Q3. Table 1 HazMat materials require placards:

- A. Only when over 1,001 lbs
- B. Only in combination vehicles
- C. Regardless of quantity — any amount**
- D. Only when mixed with other materials

Answer: C. *Table 1 materials require placards in ANY quantity transported.*

Q4. Where must shipping papers be kept while driving?

- A. In the trailer
- B. Glove compartment only
- C. Within reach of driver seat OR in door pocket**
- D. Attached to the outside of the vehicle

Answer: C. *Shipping papers must be within reach of the driver when seated OR in a door pocket when outside the cab.*

Master Quick Review

All 7 Chapters — Critical Facts for the CDL Combination Vehicles Exam

Term / Concept	Key Fact
Emergency glad hand	RED — emergency/spring brakes
Service glad hand	BLUE — normal brake application
Trailer nose — coupling	Slightly LOWER than rear of fifth wheel
Tug test	Trailer brakes set, pull in low gear — must not move
Landing gear	FULLY raised before driving
Low-pressure warning	60 PSI or below
Spring brakes apply	20–45 PSI automatically
Normal air pressure	100–125 PSI
Safety valve opens	150 PSI
Leakage — combination	Max 4 PSI per minute
Following distance	1 sec per 10 ft + 1 sec over 40 mph
Rear blind spot	200+ feet behind trailer
Front blind spot	20 feet from front bumper
Rollover cause #1	Excessive speed in curves or ramps
Brake fade	Heat from sustained downhill braking — stop to recover
Downhill gear rule	Select gear at the TOP before descending
Crack the whip	Trailer rolls during sudden swerve at speed
Jackknife cause #1	Drive axle lockup from over-braking
Trailer skid — first action	Release trailer brakes
Drive axle skid — first action	Release ALL brakes
ABS technique	Firm steady pressure + steer — never pump
Stab braking	Non-ABS vehicles ONLY
Inspection responsibility	The driver — always
Fifth wheel check	From underneath — verify jaws closed around kingpin
Slack adjusters	Less than 1 inch movement
Stopping at 55 mph	400+ feet loaded combination
Weight transfer — braking	Forward — rear axle loses traction

Center of gravity	Lower = safer — load cargo as low as possible
Liquid loads	Partial tanks MORE dangerous — liquid sloshes
HazMat placards	ALL FOUR sides — readable from 30 feet
Table 1 HazMat	Placard required ANY quantity
Table 2 HazMat	Placard required at 1,001 lbs or more
Shipping papers location	Within reach of driver seat or in door pocket
No parking near	300 feet of bridge, tunnel, or building (placarded vehicle)

Congratulations — Course Complete!

You have completed all 7 chapters of the CDL Combination Vehicles Master Course.

Review this master table, retake any practice questions you missed,
and you will be fully prepared to pass the CDL Combination Vehicles written exam.