

Name: \_\_\_\_\_

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## Final Examination

### Part I (20 questions)

Circle the letter of the correct answer from the list of multiple choices provided after each question.

1. **The Concentrated Load Capacity (CLC) marked on a scale manufactured after January 1, 1989 is:**
  - a. equivalent to the nominal capacity of the scale.
  - b. the maximum load that may be applied to a single load-bearing point.
  - c. the maximum load that may be applied anywhere on the scale within the prescribed test pattern.
  - d. the sum of the sectional capacities for the scale.
  
2. **You are inspecting a four-section vehicle scale, manufactured in 1991, with a marked CLC of 50 000 lb. The marked nominal capacity is 200 000 lb. Does the nominal capacity marking meet applicable Handbook 44 requirements?**
  - a. Yes.
  - b. No.
  
3. **The mechanical dial indicator on an axle-load scale has two faces that indicate simultaneously (one facing the driver position, the other the operator position). What tolerance applies to agreement between these indications at loads other than zero?**
  - a. Indications must agree to within one-half of the scale division.
  - b. Indications must agree to within the absolute value of the applicable tolerances for that load.
  - c. Indications must agree to within the maintenance tolerance for the scale.
  - d. There is no requirement for agreement; both indications must separately meet tolerance requirements.

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**4. You are inspecting a multiple-weighing system, consisting of five component scales and shared indicating and recording elements, all marked Class III L. Each component weighing device has a marked nominal capacity of 60 000 lb with 20 lb scale divisions. Does this system meet applicable requirements for the maximum number of scale divisions?**

- a. Yes.
- b. No.

**5. According to Handbook 44, the level portion of the approach to an axle-load scale immediately adjacent to the scale deck must be:**

- a. wider than the deck.
- b. at least 40 feet long.
- c. no longer than the deck.
- d. long enough to accommodate the longest vehicle to be weighed when the vehicle is in position for weighing.

**6. You record the following weights for successive shift tests (maintenance tolerance) of a four-section 100 000 lb x 20 lb vehicle scale with a test load of 20 000 lb (maximum available certified weights):**

Section 1: 19 980 lb  
Section 2: 20 000 lb  
Section 3: 19 980 lb  
Section 4: 20 020 lb

**Does this scale meet applicable requirements?**

- a. Yes.
- b. No.

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## Part 2

**Circle the letter for the correct term that matches the following definitions.**

- 7. The Discrimination Test is conducted on:**
- a. nonautomatic indicating scales only.
  - b. automatic indicating scales only.
  - c. balance indicators only.
  - d. scales with electronic indicators only.
- 8. The minimum net load for a 100 000 x 10 lb vehicle scale is:**
- a. 500 lb.
  - b. 1000 lb.
  - c. one-half the gross load.
  - d. none of the above; there is no minimum net load for this type of scale.
- 9. You are testing a 60 000 lb x 10 lb axle-load scale that was placed in service prior to 1986. What is the acceptance tolerance when the test load is 30 000 lb?**
- a. 10 lb
  - b. 20 lb
  - c. 30 lb
  - d. 60 lb
- 10. The minimum certified test weights required to be used for testing a 40 000 lb x 10 lb axle-load scale is:**
- a. 500 lb.
  - b. 1 000 lb.
  - c. 2000 lb.
  - d. 5 000 lb.

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- 11. What is the Sensitivity Requirement for a 100 000 lb x 10 lb vehicle scale that has a full capacity weighbeam and balance indicator and is marked Class III?**
- a. 10 lb
  - b. 20 lb
  - c. 50 lb
  - d. 200 lb
- 12. When in a balanced condition, the tip of a weighbeam must:**
- a. come to rest at the bottom of the trig loop.
  - b. come to rest at the top of the trig loop.
  - c. oscillate about or come to rest in the center of the trig loop.
  - d. continue to oscillate, touching the upper and lower limits of the trig loop alternately.
- 13. The prescribed length of the test pattern for an axle-load scale during a Shift Test is:**
- a. at least 4 feet.
  - b. the width of the scale deck
  - c. the length of the scale deck
  - d. one-half the section span.
- 14. You are testing a vehicle scale with a dial indicator and mechanical printer. The dial indicator is positioned halfway between 9 960 lb and 9 980 lb. The printed ticket shows a weight of 10 000 lb. Does this device meet applicable requirements?**
- a. Yes.
  - b. No.

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**15. What is the requirement for repeatability on vehicle and axle-load scales?**

- a. There is no requirement specified.
- b. Results from several weighings must agree exactly.
- c. Results from several weighings must agree to within the minimum maintenance tolerance for the scale being tested.
- d. Results from several weighings must agree within the absolute value of the applicable maintenance tolerance for that test load.

**16. Which of the following are required to be marked on the electronic indicating element of a vehicle scale that was that was manufactured in June 1987? Circle all correct answers.**

- a. manufacturer's ID
- b. model designation
- c. serial number
- d.  $v_{\min}$
- e. accuracy class
- f.  $n_{\max}$
- g. nominal capacity
- h. CLC
- i. d
- j. safe load limit

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- 17. A vehicle or axle-load scale with a printer must have a motion detection circuit:**
- a. to prevent movement of the scale deck, which could cause wear of the weighing elements.
  - b. to prevent the scale from printing unless it is in a stable condition to within +/- 1 scale division.
  - c. to prevent the scale from printing unless it is in a stable condition to within +/- 3 scale divisions.
  - d. to prevent the scale from printing blurred numbers on the ticket, which will result if the motion is not restricted.

- 18. You are performing an Increasing-Load Test on a 100 000 lb x 10 lb electronic vehicle scale system that is being placed into service for the first time. You apply a test load of 5 000 lb, but the resulting indication is in the zone of uncertainty between 4 990 lb and 5 000 lb. Does this scale meet the tolerance requirement?**
- a. Yes.
  - b. No.
  - c. Cannot determine.

- 19. On a mechanical dial scale, unit weights:**
- a. must be fully automatic.
  - b. must be larger than the equivalent of the face capacity.
  - c. must be enclosed within the scale cabinet.
  - d. may not be used.

- 20. When performing an Increasing-Load Discrimination Test on a digital indicating device, the test is conducted:**
- a. from just below the lower edge of the zone of uncertainty.
  - b. from just above the upper edge of the zone of uncertainty.
  - c. from the center of the zone of uncertainty.
  - d. from just within the lower limit of the zone of uncertainty.

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## **Part II (Construct Tolerance Worksheets)**

**Construct tolerance worksheets for the following two tests, using the blank worksheets on the following pages. Be sure to fill in all appropriate blanks. However, it is not necessary to fill in the values for the columns marked “Acceptable Range of Scale Indication;” you will neither receive nor lose credit for filling in the values in these columns.**

**Note: You have 30 000 lb in certified test weights to use in these tests.**

### **Test A**

You will be testing a 100 000 lb x 20 lb electronic vehicle scale with a marked CLC of 60 000 lb and a marked accuracy class of IIII. The scale has been in service for several months.

### **Test B**

You are testing an unmarked 100 000 lb x 20 lb mechanical dial scale with a 20 000 lb dial face capacity, four 20 000 lb unit weights, and a sectional capacity of 50 000 lb. The scale has been in use for several years, but is about to be returned to service after being repaired after failure to meet performance requirements in a previous scale examination.

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### Answer Key to Final Exam I

1. C
2. B (according to S.6., the nominal capacity may not exceed  $CLC \times (N - 0.5)$ ; here  $50,000 \times (4 - 0.5) = 175,000$ .)
3. A
4. B (since the scales in a multiple-weighing system constitute a single element, this system has a total of 15,000 divisions ( $60,000/20 \times 5$ ), exceeding the limitation of S.5.2. and Table 3 (10,000 divisions).
5. D
6. A
7. B
8. A
9. C
10. D
11. A
12. C
13. A
14. B
15. D
16. A, B, C, E, G, I
17. C
18. A
19. C
20. A

For Part II see completed worksheets

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TOLERANCE WORKSHEET					
MECHANICAL DIAL – VEHICLE OR AXLE-LOAD SCALE					
DIAL CAPACITY:		lb		500 d	lb
CLC or SECTION CAPACITY		lb		1000 d	lb
SCALE CAPACITY		lb		1500 d	lb
VALUE OF SCALE DIVISION		lb		2000 d	lb
NUMBER OF SCALE DIVISIONS				2500 d	lb
AVAILABLE CERT. TEST WEIGHTS		lb		3000 d	lb
MARKED IIII	Yes	No		3500 d	lb
TOLERANCE TO BE APPLIED	ACCEPTANCE		MAINTENANCE		
TEST LOAD DESCRIPTION	TEST LOAD POUNDS	TOLERANCE in d	TOLERANCE in d	ACCEPTABLE RANGE OF SCALE INDICATION	
INCREASING-LOAD AND SHIFT TEST				Minimum Pounds	Maximum Pounds
At ¼ dial capacity					
At ½ dial capacity					
At ¾ dial capacity					
At full dial capacity					
At each unit weight					
SHIFT TEST					
AT ½ CLC, SECT. CAP, OR TEST LOAD:					
Range of Results Must be within:					
CONTINUE INCREASING-LOAD AND SHIFT TEST AT EACH TOLERANCE BREAK POINT					
SHIFT TEST AT CLC, SECTION CAPACITY, OR TEST LOAD CAPACITY					
Range of Results must be within:					
DECREASING-LOAD TEST (at ½ AVAILABLE LOAD)					
STRAIN-LOAD TEST (applied only to certified test weights)					
ZERO-BALANCE CHANGE					

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TOLERANCE WORKSHEET					
ELECTRONIC – VEHICLE OR AXLE-LOAD SCALE					
CLC or SECTION CAPACITY	lb			500 d	lb
				1000 d	lb
SCALE CAPACITY	lb			1500 d	lb
VALUE OF SCALE DIVISION	lb			2000 d	lb
NUMBER OF SCALE DIVISIONS				2500 d	lb
AVAILABLE CERT. TEST WEIGHTS	lb			3000 d	lb
MARKED IIII	Yes	No		3500 d	lb
TOLERANCE TO BE APPLIED	ACCEPTANCE			MAINTENANCE	
TEST LOAD DESCRIPTION	TEST LOAD POUNDS	TOLERANCE in d	TOLERANCE in d	ACCEPTABLE RANGE OF SCALE INDICATION	
INCREASING-LOAD AND SHIFT TEST AT EACH TOL. BREAK POINT				Minimum Pounds	Maximum Pounds
SHIFT TEST					
AT ½ CLC, SECT.CAP, OR TEST LOAD:					
Range of Results Must be within:					
CONTINUE INCREASING-LOAD AND SHIFT TEST AT EACH TOLERANCE BREAK POINT					
SHIFT TEST AT CLC, SECTION CAPACITY, OR TEST LOAD CAPACITY					
Range of Results must be within:					
DECREASING-LOAD TEST (at ½ AVAILABLE LOAD)					
STRAIN-LOAD TEST (applied only to certified test weights)					
ZERO-BALANCE CHANGE					

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TOLERANCE WORKSHEET					
FULL CAPACITY BEAM – VEHICLE OR AXLE-LOAD SCALE					
BEAM CAPACITY		lb		500 d	lb
FRACTIONAL BAR CAPACITY		lb		1000 d	lb
CLC or SECTION CAPACITY		lb		1500 d	lb
SCALE CAPACITY		lb		2000 d	lb
VALUE OF SCALE DIVISION		lb		2500 d	lb
NUMBER OF SCALE DIVISIONS				3000 d	lb
AVAILABLE CERT. TEST WEIGHTS		lb		3500 d	lb
MARKED IIII	Yes	No			
TOLERANCE TO BE APPLIED	ACCEPTANCE			MAINTENANCE	
TEST LOAD DESCRIPTION	TEST LOAD POUNDS	TOLERANCE in d	TOLERANCE in d	ACCEPTABLE RANGE OF SCALE INDICATION	
INCREASING-LOAD AND SHIFT TEST AT EACH TOL. BREAK POINT				Minimum Pounds	Maximum Pounds
at ½ fractional bar cap.					
at full fractional bar cap.					
At each tolerance breakpoint.					
SHIFT TEST					
AT ½ CLC, SECT. CAP, OR TEST LOAD:					
Range of Results Must be within:					
CONTINUE INCREASING-LOAD AND SHIFT TEST AT EACH TOLERANCE BREAK POINT					
SHIFT TEST AT CLC, SECTION CAPACITY, OR TEST LOAD CAPACITY					
Range of Results must be within:					
STRAIN-LOAD TEST (applied only to certified test weights)					
ZERO-BALANCE CHANGE					

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