

## HMA Study Guide

### Terminology

- 1) Pb is the \_\_\_\_\_ of the asphalt mixture.
- 2) Gmb is the \_\_\_\_\_ specific gravity of the \_\_\_\_\_.
- 3) Gmm is the \_\_\_\_\_ theoretical specific gravity of the mixture.
- 4) Report % air voids to the nearest \_\_\_\_\_ %.
- 5) Gse is the \_\_\_\_\_ specific gravity of the \_\_\_\_\_.
- 6) VMA stands for the \_\_\_\_\_ in the \_\_\_\_\_ aggregate.
- 7) Report VMA and VMA<sub>e</sub> to the nearest \_\_\_\_\_ %.

### Mix Designs

- 8) The allowable field tolerance for % air voids under ARDOT specifications is \_\_\_\_\_ to \_\_\_\_\_ %.
- 9) The values calculated for VMA<sub>e</sub> are used when determining compliance with field specifications on an ARDOT project. True False
- 10) On ARDOT construction jobs, an asphalt mixture must be produced within the allowable field tolerances for gradation or adjustments must be made. True False
- 11) Two temperatures needed for field quality control which can be found on the ARDOT mix design are the mixing temperature and the \_\_\_\_\_ temperature.
- 12) The VMA correction factor may be found on the ARDOT mix design. True False

### Batching & Mixing

- 13) When batching aggregates for calibration samples, only oven dried aggregates should be used. True False
- 14) The mixing container should be \_\_\_\_\_ prior to mixing calibration samples to prevent low binder contents in the samples.
- 15) After mixing an asphalt specimen, the bucket must be scraped clean until the empty bucket weight is within  $\pm$  \_\_\_\_\_ g of the initial weight of the bucket.

### **AC Gauge Calibration**

- 16) ARDOT 449A requires a dry point, a \_\_\_\_\_ % point, an optimum % binder point, and a \_\_\_\_\_ % point for all calibrations.
- 17) A minimum of \_\_\_\_\_ wet points must be used when performing a calibration.
- 18) Sample pans of an AC Gauge are loaded in \_\_\_\_\_ layers (lifts).
- 19) The dry point is used for determining the \_\_\_\_\_ weight for all samples.
- 20) All calibration times including the background count, should be set for \_\_\_\_\_ minutes.
- 21) When completed, a calibration must achieve a fit coefficient of at least \_\_\_\_\_ to be considered a valid calibration.

### **Ignition Oven Calibrations**

- 22) Sample masses may not exceed the required minimum masses by more than \_\_\_\_\_ grams.
- 23) If two calibration samples differ by more than \_\_\_\_\_ %, then two more samples must be burned at the same temperature for the calibration.
- 24) If the calibration factor determined is greater than \_\_\_\_\_ % at 538 °C, then the calibration temperature is lowered to \_\_\_\_\_ ° C and the procedure is repeated.
- 25) Aggregate correction factors are always applied to all sieves.      True      False

### **Sampling Asphalt Mixtures**

- 26) When sampling from a truck, you must gather your field sample from a minimum of \_\_\_\_\_ different locations within the truck.
- 27) When transporting asphalt samples, contamination, \_\_\_\_\_ of material and \_\_\_\_\_ loss should be avoided.

**Reduction of HMA Samples to Testing Size**

- 28) The equipment used in reducing samples may be heated up to the maximum \_\_\_\_\_ temperature to help reduce temperature loss.
- 29) WD 40 or diesel oil may be used as a release agent to coat reduction equipment.  
True      False
- 30) Reduction of samples to testing size may be accomplished using a mechanical \_\_\_\_\_, the quartering method, or the \_\_\_\_\_ method.

**Gyratory Compaction**

- 31) The gyratory compactor must be able to exert \_\_\_\_\_  $\pm$  \_\_\_\_\_ kPa of force to a specimen after the first five gyrations.
- 32) The internal angle required by AASHTO T 312 for a gyratory compactor is \_\_\_\_\_  $\pm$  0.02 degrees.
- 33) The speed of gyration during compaction is required to be \_\_\_\_\_  $\pm$  0.5 gyrations per minute.
- 34) To properly compact a specimen for ARDOT quality control/acceptance testing, the gyratory must be set to compact to the \_\_\_\_\_ number of gyrations shown on the mix design for the mixture.
- 35) Molds and plates must be preheated to the compaction temperature for a minimum of \_\_\_\_\_ minutes before use and at least \_\_\_\_\_ minutes between uses.
- 36) The required height of a gyratory specimen is \_\_\_\_\_  $\pm$  5 mm.
- 37) Specimens compacted for quality control must be compacted at the mixing temperature.  
True      False
- 38) Asphalt mixtures are placed into a gyratory mold in \_\_\_\_\_ lift(s).

**Bulk Specific Gravity (Gmb)**

- 39) The water bath used in AASHTO T 166 is required to have an overflow device to control the water level in the tank and to maintain a temperature of \_\_\_\_\_  $\pm$  \_\_\_\_\_  $^{\circ}$  F during testing.
- 40) When drying back a specimen prior to testing under AASHTO T 166, the maximum allowable temperature is \_\_\_\_\_  $\pm$  5 $^{\circ}$  F to prevent destroying the specimen.
- 41) When weighing under water, specimens should be immersed for \_\_\_\_\_  $\pm$  \_\_\_\_\_ minute(s) prior to recording the submerged weight.
- 42) Report Gmb to the nearest \_\_\_\_\_ and absorption to the nearest \_\_\_\_\_ %.
- 43) AASHTO T 166 may only be used for specimens which have \_\_\_\_\_ % or less absorption.
- 44) For specimens which have more than 2% absorption, AASHTO \_\_\_\_\_ or AASHTO \_\_\_\_\_ must be used to report the bulk specific gravity of the specimen.
- 45) When coating a specimen with paraffin, it is important to ensure that the entire surface of the specimen is sealed with paraffin.      True      False
- 46) When conducting AASHTO T 331 (Vacuum Sealing), a maximum loss of \_\_\_\_\_ % or \_\_\_\_\_ % gain is allowed between the initial and final weights of the specimen weighed in air.

**Max. Theoretical SpG (Gmm)**

- 47) Samples containing moisture must be dried at \_\_\_\_\_  $\pm$  9  $^{\circ}$ F until further drying does not alter the mass by more than \_\_\_\_\_ %.
- 48) While warm, samples must be separated during cooling so that there are no fine clumps greater than \_\_\_\_\_ inch in size to prevent trapped air from influencing the test results.
- 49) After weighing the dry sample in air, the sample is covered with water and a vacuum of \_\_\_\_\_  $\pm$  0.3 kPa or \_\_\_\_\_  $\pm$  2.5 mm Hg is applied for \_\_\_\_\_  $\pm$  2 minutes.
- 50) During vacuuming, the specimen must be agitated at a minimum of \_\_\_\_\_ minute intervals.
- 51) After vacuuming is complete, the vacuum must be released at rate that does not exceed \_\_\_\_\_ kPa/s or \_\_\_\_\_ mm Hg/s.

- 52) After vacuum is released, the vacuum bowl with sample is submerged in the water bath for \_\_\_\_\_  $\pm$  1 minutes and the submerged mass of the vacuum bowl and sample is recorded.
- 53) To obtain the standardized submerged weight of a vacuum bowl, the three submerged weight determinations must not vary by more than \_\_\_\_\_ g.

### **Moisture Content of HMA**

- 54) The temperature required for drying an asphalt mixture is the \_\_\_\_\_ range shown on an ARDOT mix design.
- 55) To determine the moisture content of an asphalt sample, the sample must be \_\_\_\_\_ and then dried for an initial period of \_\_\_\_\_ minutes.
- 56) After the initial drying period, weights are checked on \_\_\_\_\_ minute intervals until constant mass is achieved.
- 57) After constant mass is achieved the sample is cooled to room temperature before obtaining the final weight.      True      False
- 58) Report moisture content of asphalt mixtures to the nearest \_\_\_\_\_ %.

### **AC Gauge Field Testing**

- 59) Prior to testing an asphalt sample in the field, a daily \_\_\_\_\_ count must be taken and the proper \_\_\_\_\_ activated in the gauge.
- 60) The test times allowed for field testing are \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_ minutes.
- 61) To conduct a field test for binder content using an asphalt content gauge, the sample pans should be filled to within  $\pm$  \_\_\_\_\_ grams of the calibration weight.
- 62) Field samples should be tested within  $\pm$  \_\_\_\_\_ °F of the calibration temperature.
- 63) The reported % binder is computed by subtracting the moisture content from the gauge reading and rounding to the nearest \_\_\_\_\_ %.

### **Ignition Oven Field Testing**

- 64) The standard field operating temperature of the ignition oven is either \_\_\_\_\_ °C or \_\_\_\_\_ °C based on the \_\_\_\_\_ temperature.
- 65) The \_\_\_\_\_ mass of the sample is obtained and entered into the ignition oven for computation of the binder content.
- 66) The total mass of the basket assembly and sample is used to check proper weighing of the scale within the ignition oven and must check within ± \_\_\_\_\_ grams of an outside scale.
- 67) The reported binder content using an ignition oven is obtained by subtracting any moisture in the tested sample from the calibrated asphalt binder content shown on the ticket, and then rounding the result to the nearest 0.1 %.      True      False

### **Ignition Oven – Mechanical Analysis**

- 68) When washing a sieve analysis sample after an ignition oven burn, you must use a \_\_\_\_\_ to help in the removal of any asphalt coatings still on the aggregate.
- 69) Required aggregate correction factors are applied prior to rounding for the reported values.      True      False

### **Solvent Wash**

- 70) When performing an ARDOT solvent wash, you must know the \_\_\_\_\_ content, and \_\_\_\_\_ of mixture prior to washing with solvent.
- 71) After solvent washing, the solvent residue must be rinsed from the remaining aggregate with \_\_\_\_\_ using liquid detergent if needed prior to drying the sample.
- 72) Report the % passing the # 200 sieve to the nearest \_\_\_\_\_ %.

### **Rolling Patterns**

- 73) Rolling patterns are required for ARDOT asphalt paving projects.      True      False
- 74) When establishing a rolling pattern, \_\_\_\_\_ second tests are conducted and each \_\_\_\_\_ density reading is recorded.

### **Sampling Cores**

- 75) When obtaining a sample by coring an asphalt pavement, \_\_\_\_\_ or air should be used to prevent damage to the edge of the cores caused by friction during the cutting process.
- 76) When transporting cores, the cores should be \_\_\_\_\_ and protected from \_\_\_\_\_ temperatures.
- 77) According to ARDOT specifications, if the density of an asphalt pavement is to be determined by cutting cores, \_\_\_\_\_ core is required for every lot or subplot of material.
- 78) The minimum diameter of an acceptable core sample is \_\_\_\_\_ inches in diameter.
- 79) According to ARDOT specifications, tests for mat density or % compaction of an asphalt pavement should not be taken within \_\_\_\_\_ feet of the pavements' edge.

### **Joint Densities**

- 80) The longitudinal joint between a shoulder and travel lane is subject to joint density testing.  
True      False
- 81) Joint density cores shall be \_\_\_\_\_ inches in diameter.
- 82) When the asphalt mixture forming the two sides of a longitudinal joint comes from two different sublots, \_\_\_\_\_ the theoretical maximum specific gravity for the two sublots.
- 83) The random core locations for final surface course joint densities will match the same station locations where mat densities were measured.      True      False

### **Density (Nuclear Gauge)**

- 84) Before using a nuclear density gauge on a job, a \_\_\_\_\_ must be taken daily to determine if the gauge is operating correctly.
- 85) A suitable location for conducting a standard count is an \_\_\_\_\_ surface, \_\_\_\_\_ feet away from large objects and \_\_\_\_\_ feet away from other nuclear gauges.
- 86) The use of a nuclear density gauge for determining density of an asphalt pavement requires the determination of a \_\_\_\_\_ correction factor for each gauge, mix, and every job.

- 87) \_\_\_\_\_ core correction factors are needed to compute each job correction factor.
- 88) In determining each core correction factor, four \_\_\_\_\_ density readings are taken within \_\_\_\_\_ foot of the core location.
- 89) When using the backscatter method on a cold asphalt mat to determine density, set the time to \_\_\_\_\_ minute(s) and the depth to \_\_\_\_\_.
- 90) To determine the density of an asphalt pavement using a nuclear density gauge, \_\_\_\_\_ random test locations are required for each subplot or lot of material.
- 91) Report % compaction to the nearest \_\_\_\_\_ %.

### **ARDOT Specifications**

- 92) An ARDOT "Lot" of asphalt consists of \_\_\_\_\_ tons, while an ARDOT "Sublot" of asphalt consists of \_\_\_\_\_ tons.
- 93) ARDOT specifications are considered \_\_\_\_\_ limits.
- 94) Pay items for an ARDOT asphalt paving project are % binder, % air \_\_\_\_\_, % \_\_\_\_\_, and % \_\_\_\_\_.
- 95) The standard ARDOT specification for % compaction is \_\_\_\_\_ % to \_\_\_\_\_ % for normal travel surfaces and widths.