

## HMA Study Guide

### Terminology

- 1)  $P_b$  is the \_\_\_\_\_ of the asphalt mixture.
- 2)  $G_{mb}$  is the \_\_\_\_\_ specific gravity of the \_\_\_\_\_.
- 3)  $G_{mm}$  is the \_\_\_\_\_ theoretical specific gravity of the mixture.
- 4)  $G_{se}$  is the \_\_\_\_\_ specific gravity of the \_\_\_\_\_.
- 5) VMA stands for the \_\_\_\_\_ in the \_\_\_\_\_ aggregate.

### Mix Designs

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

### Batching & Mixing

- 11) When batching aggregates for calibration samples, only oven dried aggregates should be used.      True      False
- 12) Binder may be heated overnight in an oven prior to mixing samples.      True      False
- 13) The mixing container should be \_\_\_\_\_ prior to mixing calibration samples to prevent low binder contents in the samples.
- 14) Mix samples at least \_\_\_\_\_ minutes or until \_\_\_\_\_ coated.
- 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**

- 17) ARDOT 449A requires a minimum of \_\_\_\_\_ wet points during calibration; a \_\_\_\_\_ % point, an optimum % binder point, and a \_\_\_\_\_ % point for all calibrations.
- 18) Sample pans of an AC Gauge are loaded in \_\_\_\_\_ layers (lifts).
- 19) The dry point is used for determining the \_\_\_\_\_ weight.
- 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) A sample mass may not exceed the required minimum mass 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

### **Applications**

- 26) Application rate is the \_\_\_\_\_ of asphalt needed to cover a square yard in order to produce the required \_\_\_\_\_ of pavement.
- 27) Application rates are generally found on the job \_\_\_\_\_.

### **Sampling Asphalt Mixtures**

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

### **Reduction of HMA Samples to Testing Size**

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

### **Gyratory Compaction**

- 33) The gyratory compactor must be able to exert \_\_\_\_\_  $\pm$  \_\_\_\_\_ kPa of force to a specimen after the first five gyrations.
- 34) The internal angle required by AASHTO T 312 for a gyratory compactor is \_\_\_\_\_  $\pm$  0.02 degrees.
- 35) The speed of gyration during compaction is required to be \_\_\_\_\_  $\pm$  0.5 gyrations per minute.
- 36) 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.
- 37) Molds and plates must be preheated to the compaction temperature for a minimum of \_\_\_\_\_ minutes before use and at least \_\_\_\_\_ minutes between uses.
- 38) The required height of a gyratory specimen is \_\_\_\_\_  $\pm$  5 mm.
- 39) Asphalt mixtures are placed into a gyratory mold in \_\_\_\_\_ lift(s).

### **Bulk Specific Gravity (Gmb)**

- 40) 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 \_\_\_\_\_  $\pm$  \_\_\_\_\_ ° F during testing.
- 41) When drying back a specimen prior to testing under AASHTO T 166, the maximum allowable temperature is \_\_\_\_\_  $\pm$  5° F to prevent destroying the specimen.

- 42) Specimens should be cooled to room temperature before testing.  
True      False
- 43) When weighing under water, specimens should be immersed for \_\_\_\_\_  $\pm$  \_\_\_\_\_ minute(s) prior to recording the submerged weight.
- 44) Report Gmb to the nearest \_\_\_\_\_ and absorption to the nearest \_\_\_\_\_ %.
- 45) AASHTO T 166 may only be used for specimens which have \_\_\_\_\_ % or less absorption.
- 46) For specimens which have more than 2 % absorption, the \_\_\_\_\_ sealing method or the \_\_\_\_\_ coating must be used to report the bulk specific gravity of the specimen.

### **Max. Theoretical SpG (Gmm)**

- 47) While warm, samples must be separated during cooling so that there are no fine clumps greater than \_\_\_\_\_ inch in size to prevent trapped air between particles from influencing the test results.
- 48) After weighing the dry sample in air, the sample is covered with water and a vacuum of \_\_\_\_\_  $\pm$  0.6 kPa or \_\_\_\_\_  $\pm$  5 mm Hg is applied for \_\_\_\_\_  $\pm$  1 minutes.
- 49) During vacuuming, the specimen must be agitated at least every \_\_\_\_\_ minutes.
- 50) After vacuuming is complete, the vacuum must be released \_\_\_\_\_.
- 51) After vacuum is released, the vacuum bowl with sample is submerged in the water bath for \_\_\_\_\_  $\pm$  1 min. and the submerged mass is recorded.
- 52) To obtain the standardized submerged weight of a vacuum bowl, the three submerged weight determinations must not vary by more than \_\_\_\_\_ g.

### **Paraffin Coating & Vacuum Sealing Gmb**

- 53) When coating a specimen with paraffin, it is important to ensure that the entire surface of the specimen is sealed with paraffin.      True      False
- 54) When vacuum sealing a specimen, the specimen is placed with the \_\_\_\_\_ side of the specimen down inside the sealing bag to prevent punctures.

- 55) After weighing the sealed specimen in water, the bag must be cut open and the specimen \_\_\_\_\_ in air to obtain the final weight of the specimen.

### **Moisture Content of HMA**

- 56) The temperature required for drying asphalt for a moisture content determination is the \_\_\_\_\_ range shown on an ARDOT mix design.
- 57) After weighing, the asphalt mixture is dried for an initial period of \_\_\_\_\_ minutes.
- 58) Checks are made every \_\_\_\_\_ minutes until constant mass is achieved.
- 59) The sample is brought to the \_\_\_\_\_ temperature before obtaining the final weight.
- 60) Report moisture content of asphalt mixtures to the nearest \_\_\_\_\_ %.

### **AC Gauge Field Testing**

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

### **Ignition Oven Field Testing**

- 66) The standard field operating temperature of the ignition oven is either \_\_\_\_\_ °C or \_\_\_\_\_ °C based on the \_\_\_\_\_ temperature.
- 67) The \_\_\_\_\_ mass of the sample is obtained and entered into the ignition oven for computation of the binder content.

- 68) Prior to placing the loaded basket into the ignition oven, the internal scale should be reading \_\_\_\_\_.
- 69) 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  $\pm$  \_\_\_\_\_ grams of an outside scale.
- 70) 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**

- 71) When washing a sieve analysis sample after an ignition oven burn, a \_\_\_\_\_ agent is used to assure separation of the finer materials.
- 72) Required aggregate correction factors are applied prior to rounding for the reported sieve analysis results. True False

### **Solvent Wash**

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

### **Rolling Patterns**

- 76) The purpose of a rolling pattern is to determine the \_\_\_\_\_ of passes required to achieve \_\_\_\_\_ with the onsite \_\_\_\_\_.
- 77) Rolling patterns are required for ARDOT asphalt paving projects. True False
- 78) When establishing a rolling pattern, \_\_\_\_\_ second tests are conducted and each \_\_\_\_\_ density reading is recorded.

### **Sampling Cores / Density**

- 79) 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.
- 80) When transporting cores, the cores should be \_\_\_\_\_ and protected from \_\_\_\_\_ temperatures.
- 81) After cutting a core, the core hole should be filled with \_\_\_\_\_ mix.
- 82) Report % compaction to the nearest \_\_\_\_\_ %.
- 83) According to ARDOT specifications, tests for mat density or % compaction of an asphalt pavement should not be taken within \_\_\_\_\_ feet of the pavements' edge.

### **ARDOT Specifications**

- 84) An ARDOT "Lot" of asphalt consists of \_\_\_\_\_ tons, while an ARDOT "Sublot" of asphalt consists of \_\_\_\_\_ tons.
- 85) Pay items for an ARDOT asphalt paving project are % binder, % air \_\_\_\_\_, % \_\_\_\_\_, and % \_\_\_\_\_.
- 86) The standard ARDOT specification for % compaction is \_\_\_\_\_ % to \_\_\_\_\_ % for normal travel surfaces and widths.

### **Joint Densities**

- 87) Joint density cores shall be \_\_\_\_\_ inches in diameter.
- 88) Joint density cores for a butt joint should be cut centered over the \_\_\_\_\_ joint line.
- 89) Joint density cores for wedge joints should be cut centered over the \_\_\_\_\_ width.
- 90) The longitudinal joint between a shoulder and travel lane is subject to joint density testing. True False

**Mix Design Performance Tests**

- 1) The asphalt pavement analyzer (APA) is used to test asphalt mixtures for \_\_\_\_\_.
- 2) The Ideal CT test is used for testing an asphalt mixture's resistance to \_\_\_\_\_.