**10. Engineering Materials – Metals & Wood**

Name and date submitted (3 pts):

Instructions: Using this form as a template, create space in the document below and write or type your answers. KEEP THE SAME NUMBERING.

(15 questions, 100 points possible).

1. Steel: Referring to your textbook, complete the table:

|  |  |
| --- | --- |
|  | % carbon by weight |
| Low carbon steel |  |
| Medium carbon steel |  |
| High carbon steel |  |

1. Steel alloys: Referring to your textbook, complete the table:

|  |  |  |
| --- | --- | --- |
|  | Name of alloy (Series) | Major alloying elements |
| Structural applications like I-beams and H-beams |  |  |
| Marine applications |  |  |
| Fasteners, aircraft fittings, shafts |  |  |
| General purpose machine parts |  |  |
| Piston rods, gears, tools |  |  |
| Cutlery (knives) |  |  |

The next 5 questions refer to the document “Standard Specification for Carbon Structural Steel”.

1. Refer to section 1, “Scope”, paragraph 1.1. What is A-36 structural steel used for?
2. Refer to Table 2. What is the acceptable range of Carbon content, in maximum %, for the various shapes, plates, and bars?

From \_\_\_\_\_\_\_\_% to \_\_\_\_\_\_\_\_\_\_%

1. Table 2: What additional 5 elements are present in A-36 steel?
	* 1.
		2.
		3.
		4.
		5.
2. Table 3: What is the required “tensile strength” in pounds per square inch (psi) for plates, shapes, and bars? (Note: 1 ksi is equivalent to 1,000 psi).

Range = \_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_ lbs/sq. in.

1. Table 3: What is the required “yield point” (in psi) for plates, shapes, and bars? Now do you see where the designation “A-36” comes from?

Yield point = \_\_\_\_\_\_\_\_\_\_ psi

1. Refer to your textbook on “Bronze”.
	1. Bronze is an alloy of what 2 metals?

|  |  |
| --- | --- |
|  | Percentage % |
| Metal 1 |  |
| Metal 2 |  |

* 1. Why are boat propellers made of bronze?
	2. Why are gears, bearings, and bushings made of bronze?
1. Refer to your textbook on “Brass”.
	1. Brass is an alloy of what 2 metals?

|  |  |
| --- | --- |
|  | Percentage % |
| Metal 1 |  |
| Metal 2 |  |

* 1. Why is brass more difficult to produce than bronze?
	2. Why is brass an excellent material for munitions casings?
1. Refer to your textbook on “Aluminum”. Complete the table:

|  |  |  |
| --- | --- | --- |
|  | Name of alloy (Series) | Major alloying elements |
| Bicycle frames, rock climbing gear |  |  |
| Aircraft wings and fuselage parts that experience tension |  |  |
| Armor plate, boat and yacht hulls |  |  |
| Transportation equipment |  |  |
| Electrical fittings, decorative hardware, brake pistons, hydraulic pistons, valves and valve parts |  |  |

1. Refer to your textbook on “Wood/Timber”
	1. Wood is comprised of two materials (natural polymers) known as “C\_\_\_\_\_\_\_\_\_\_\_\_” and “L\_\_\_\_\_\_\_\_\_\_\_\_\_\_”.
	2. Refer to Fig. 9-23 and the textbook discussion which follows. Contrast and compare Sapwood with Heartwood.
		1. Sapwood:
		2. Heartwood:
	3. Fig. 9-27. What are five (5) common softwoods?
	4. Fig. 9-31. What are six (6) common American hardwoods?
2. Board feet: Refer to your workbook exercise 9.5 for an example

How many board feet of lumber are in a piece of wood ¾ in. thick x 12 in. wide x 20 ft. long? SHOW YOUR WORK

The next 3 questions refer to the document “Allowable Span Tables”

1. What joist system would you need to support a floor which spans 15’-0”. The floor is supporting a living area with carpet flooring.
	* 1. Size of joist \_\_\_\_\_\_\_\_\_\_\_\_ (for example: 2x4, 2x6, 2x8, etc.)
		2. Spacing in inches \_\_\_\_\_\_\_\_\_\_\_\_\_ (for example: 12”, 16”, 24”)
2. Same facts as above, but now assume the floor needs to support a “living area” with “tile/stone” as the flooring material.
	* 1. Size of joist \_\_\_\_\_\_\_\_\_\_\_\_ (for example: 2x4, 2x6, 2x8, etc.)
		2. Spacing in inches \_\_\_\_\_\_\_\_\_\_\_\_\_ (for example: 12”, 16”, 24”)
3. Assume the building will have an open (vaulted) ceiling, with the “ceiling attached to rafters” (see Table 2). The roofing material is asphalt shingles. What rafter system would you specify assuming you need to span 15’-0” with the rafters. (There is more than one possibility. Try to choose the least expensive alternative.)
	* 1. Size of rafter \_\_\_\_\_\_\_\_\_\_\_\_ (for example: 2x4, 2x6, 2x8, etc.)
		2. Spacing in inches \_\_\_\_\_\_\_\_\_\_\_\_\_ (for example: 12”, 16”, 24”)