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A primary industry is one that cultivates and exploits natural resources, such as agriculture or mining. A secondary industry takes the outputs of primary industries and converts them to consumer and capital goods. Examples of secondary industries are textiles and electronics. A tertiary industry is in the service sector of the economy. Examples of tertiary industries are banking and education. 1.2 What is a capital good? Provide an example. Answer. Capital goods are those purchased by companies to produce goods or provide services. Examples of capital goods are aircraft and construction equipment. 1.3 How are product variety and production quantity related when comparing typical factories? Answer. Generally production quantity is inversely related to product variety. A factory that produces a large variety of products will produce a smaller quantity of each. A company that produces a single product will produce a large quantity. 1.4 Define manufacturing capability. Answer. Manufacturing capability refers to the technical and physical limitations of a manufacturing firm and each of its plants. Three categories of capability mentioned in the text are (1) technological processing capability, (2) physical size and weight, and (3) production capacity. 1.5 Name the three basic categories of materials. Answer. The three basic categories of engineering materials are (1) metals, (2) ceramics, and (3) polymers. A fourth category, composites, is a non-homogeneous mixture of the other types and therefore is not a basic category. 1.6 How does a shaping process differ from a surface processing operation? Answer. A shaping process changes the geometry of the work material (machining or forging). A surface processing operation does not alter the geometry, but instead alters surface of the work (painting or plating). 1.7 What are two subclasses of assembly processes? Provide an example process for each subclass. Answer. The two subclasses of assembly processes are (1) permanent joining and (2) mechanical fastening. Examples of permanent joining include welding or adhesive bonding. Examples of mechanical fastening include threaded fasteners, such as nuts and bolts, and rivets. 1.8 Define batch production and describe why it is often used for medium-quantity production products. Answer. Batch production is where groups, lots, or batches of materials or parts are processed together through the manufacturing operations. All units in the batch are processed at a given station before the group proceeds to the next station. In a medium or low quantity production situation, the same machines are used to produce many types of products. Whenever a machine switches from one product to another, a changeover occurs. The changeover requires the machine setup to be torn down and set up for the new product. Batch production allows the changeover time Solutions for Fundamentals of Modern Manufacturing, 4/e (published by Wiley) MPMGroover 2010 06-19-09 Excerpts from this work may be reproduced by instructors for distribution on a not-for-profit basis for testing or instructional purposes only to students enrolled in courses for which the textbook has been adopted. Any other reproduction or translation of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful. 2 to be distributed across a larger number of parts and hence reduce the average operation time per part. 1.9 What is the difference between a process layout and a product layout in a production facility? Answer. A process layout is one where the machinery in a plant is arranged based on the type of process it performs. To produce a product it must visit the departments in the order of the operations that must be performed. This often includes large travel distances within the plant. A process layout is often used when the product variety is large the operation sequences of products are dissimilar. A product layout is one where the machinery is arranged based on the general flow of the products that will be produced. Travel distance is reduced because products will generally flow to the next machine in the sequence. A product layout works well when all products tend to follow the same sequence of production. 1.10 Name two departments that are typically classified as manufacturing support departments. Answer. A common organizational structure includes the following three manufacturing support departments: (1) manufacturing engineering, (2) production planning and control, and (3) quality control. Multiple Choice Quiz There are 18 correct answers in the following multiple choice questions (some questions have multiple answers that are correct). To attain a perfect score on the quiz, all correct answers must be given. Each correct answer is worth 1 point. Each omitted answer or wrong answer reduces the score by 1 point, and each additional answer beyond the correct number of answers reduces the score by 1 point. Percentage score on the quiz is based on the total number of correct answers. 1.1 Which of the following industries are classified as secondary industries (three correct answers): (a) beverages (b) financial services, (c) fishing, (d) mining, (e) power utilities, (f) publishing, and (g) transportation? Answer. (a), (e), and (f). 1.2 Mining is classified in which one of the following industry categories: (a) agricultural industry, (b) manufacturing industry, (c) primary industry, (d) secondary industry, (e) service industry, or (f) tertiary industry? Answer. (c). 1.3 Inventions of the Industrial Revolution include which one of the following: (a) automobile, (b) cannon, (c) printing press, (d) steam engine, or (e) sword? Answer. (d). 1.4 Ferrous metals include which of the following (two correct answers): (a) aluminum, (b) cast iron, (c) copper, (d) gold, and (e) steel? Answer. (c) and (e). 1.5 Which one of the following engineering materials is defined as a compound containing metallic and nonmetallic elements: (a) ceramic, (b) composite, (c) metal, or (d) polymer? Answer. (a). 1.6 Which of the following processes start with a material that is in a fluid or semifluid state and solidifies the material in a cavity (two best answers): (a) casting, (b) forging, (c) machining, (d) molding, (e) pressing, and (f) turning? Answer. (a) and (d). Solutions for Fundamentals of Modern Manufacturing, 4/e (published by Wiley) MPMGroover 2010 06-19-09 Excerpts from this work may be reproduced by instructors for distribution on a not-for-profit basis for testing or instructional purposes only to students enrolled in courses for which the textbook has been adopted. Any other reproduction or translation of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful. 3 1.7 Particulate processing of metals and ceramics involves which of the following steps (two best answers): (a) adhesive bonding, (b) deformation, (c) forging, (d) material removal, (e) melting, (f) pressing, and (g) sintering? Answer. (f) and (g). 1.8 Deformation processes include which of the following (two correct answers): (a) casting, (b) drilling, (c) extrusion, (d) forging, (e) milling, (f) painting, and (g) sintering? Answer. (c) and (d). 1.9 Which one of the following is a machine used to perform extrusion: (a) forge hammer, (b) milling machine, (c) rolling mill, (d) press, (e) torch? Answer. (d). 1.10 High-volume production of assembled products is most closely associated with which one of the following layout types: (a) cellular layout, (b) fixed position layout, (c) process layout, or (d) product layout? Answer. (d). 1.11 A production planning and control department accomplishes which of the following functions in its role of providing manufacturing support (two best answers): (a) designs and orders machine tools, (b) develops corporate strategic plans, (c) orders materials and purchased parts, (d) performs quality inspections, and (e) schedules the order of products on a machine? Answer. (c) and (e). Solutions for Fundamentals of Modern Manufacturing, 4/e (published by Wiley) MPMGroover 2010 03-02-09, 03-02-09 Excerpts from this work may be reproduced by instructors for distribution on a not-for-profit basis for testing or instructional purposes only to students enrolled in courses for which the textbook has been adopted. Any other reproduction or translation of this work beyond that permitted by Sections 107 or 108 of the 1976 United States Copyright Act without the permission of the copyright owner is unlawful. 1.2 THE NATURE OF MATERIALS Review Questions 2.1 The elements listed in the Periodic Table can be divided into three categories. What are these categories and give an example





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