k. As a verb its past participle is always spelled with the *k, shellacked*. If spelled *shellaced,* it must be pronounced with a soft sound of the *c,* as in the word *laced,* which is not admissible. When the word *arc* as a verb shall find a place in the dictionaries, it would seem that it must be treated in a similar manner, and have the *k* inserted in its past forms, and for a similar reason.

(10395) J. P. says: Please give a recipe for a cement that will fasten unglazed porcelain to iron. A. 1. Melt carpenter's glue in wine vinegar, add a little Venice turpentine and boil up for half a day over a slow fire. 2. Mix 15 parts copal varnish, 5 parts drying oil, 5 parts turpentine, and 5 parts liquefied glue, and set in boiling water until all are melted together. Then stir in 10 parts of slaked lime. Use immediately.

(10396) W. H. T. asks: How is gas made from water? Is there a book that would enable a foundry foreman to learn how to make an analysis of the iron in his castings? A. Briefly described, water gas is produced by blowing steam through a layer of brightly glowing coal; the water is decomposed, and the coal is consumed; the gases coming off are a mixture of hydrogen, carbon monoxide, and hydrocarbons, with small amount of carbonic dioxide, and variable amount of nitrogen. When the coal cools off too far to further decompose the water vapor, this is shut off, and air is blown through until the coal again burns brightly and is ready for more steam. While the air is blown in, the gases are allowed to escape up the chimney, as they have no value as illuminant, and in fact would not burn at all. The water gas as it comes from the producer has very little illuminating power. This is imparted to it by enriching with benzine. There is no book which would explain to anyone not a chemist how to determine the amount of iron in brass or other castings. Such work must be done by a chemist. All books on analytical chemistry of the metals describe methods for this, but would be unintelligible to any person except a regular chemist.

(10397) R. G. P. asks: Are there any chime music boxes with a set of bells on them? How does the name chime get its name? A. The word chime comes from a Latin word, meaning bell, and also cymbal. Music boxes are made with sets of bells in them.

(10398) E. G. P. asks: How can a scratch be removed from the top of an oak table (highly polished)? A. If the scratch is only a slight, superficial one, it can usually be removed by rubbing with a rag soaked with crude oil. If a deep scratch, it will be best to rub down the whole top of the table with powdered pumice and crude oil, and then revarnish.

(10399) G. P. O. wishes a process for galvanizing such as is done on the base boards for stoves. A. The article to be galvanized is first thoroughly cleaned by dipping in weak muriatic or sulphuric acid, and is then thoroughly dried. After this it is plunged in a bath of molten zinc, wherein it becomes coated with a layer of zinc, being what is known as galvanized. The surface of the molten zinc must be kept clean by sprinkling with powdered sal ammoniac and skimming off the dross from time to time.

(10400) G. G. G. asks: How can I gild or marble edges of books, to resemble as nearly as possible those gilded by publishers? A. To gild the edges of books, they are first trimmed smooth, then sized with egg albumen (white of egg) and gold leaf then applied. When dry it is burnished with agate burnisher. For mottling, a very thin solution of gum arabic is prepared in a tray, and the different colors are then shaken in or combed in. A half dozen or so of the books are held securely and evenly together, and the top, bottom and front edges are successively dipped in lightly, and the excess of color is each time blown off. Successful marbling is quite expert work.

(10401) W. J. D. asks: 1. Is there any method by which soft coal can be made into brick or lump form by mixing with other substances or by itself? A. The powdered or crushed soft coal can be pressed into bricks and then be partially coked to give strength. If the coal alone will not adhere sufficiently well on pressure, it can be mixed with pitch, and then partially coked. 2. Can the ordinary 150 deg. test kerosene oil be clarified to prevent the strong smell while burning in a lamp or wick oil stove? A. A good quality of kerosene will not give much odor in burning in a lamp or wick oil stove, if care be taken to keep the wick well trimmed, and to adjust so that it will burn without smoke. There is no way to further purify kerosene oil, as to make it burn without odor.

(10402) W. H. A. asks: 1. Does the process of steaming wood in any manner destroy the life of wood, and are there any limits to this destruction? A. The steaming of wood for bending purposes seems to do no injury, as the lasting quality of wood so treated is very evident in our old ships and bent wood in agricultural implements. 2. In small-boat construction is there any special process for steaming wood (pine or oak)? A. The universal practice is simply a wooden steam box connected to a closed kettle of water over a fire. 3. If there is a destruction of the vitality of woods, would there be a way of lessening this effect? A. Even the steam boxes in use for many years retain vitality and strength in the wood to a surprising extent. We know of no needed improvement.

(10403) C. H. H. says: I wish to use my gasoline car during cold weather. Kindly tell me whether chloride of lime, added to the water used to absorb heat from the cylinders, will prevent the water from freezing when the machine is not in use, and the water is cold. What proportion of chloride of calcium should I use? What weight per gallon of water? A. Chloride of calcium (not chloride of lime) can be used to lower the freezing point of water. All dissolved salts tend to corrode metal more quickly than pure water, hence care should be taken to clean up occasionally so as to prevent corrosion.

(10404) H. E. H. wishes the exact number of pounds (16 ounces) a cubic foot of hydrogen gas will raise. A. One thousand cubic feet of hydrogen weighs 75 pounds less than 1,000 cubic feet of air at normal pressure and at the freezing point of water. It is customary to allow 70 pounds as the lifting power of 1,000 feet of hydrogen in a balloon, the difference being to provide for some advantage on the part of the hydrogen. It would balance 75 pounds, but lift 70 pounds with case.

(10405) W. A. H. G. asks: 1. Can a plain slide valve steam engine be run by compressed (hot) air, or must the valves or packing be changed? A. Any engine that is suitable for steam is equally suitable for compressed air. 2. When air is compressed to one-fourth its volume, would it have four times the pressure (60 pounds per square inch)? Immediately after the air is compressed, its temperature will be quite high. After cooling, how much would the pressure decrease? A. Air compressed to one-fourth its volume without loss of heat will have a pressure of 89 pounds per square inch, or 60 pounds without heat, isothermal.

(10406) W. H. D. asks: 1. Is the hot flame from a needle hole through which passes the hot gases of vaporized kerosene a "boring" flame, as common gas is held to be, even on iron? A. All vapor gas jets when made to impinge on any body that will burn by heat may be said to be a boring flame. 2. If it is not a boring flame, is it advisable to apply it, in the firepot of a furnace, directly to the sides of the firepot to heat water or generate steam for house heating? A. A jet flame of any kind should not impinge directly upon a firepot, but directed around it. 3. If it is a boring flame, how can it be applied most economically for such heating? A. By jetting the flame around the firepot in a chamber of firebrick. 4. How can this fuel and flame be applied most economically to furnaces heating by hot air? A. By jetting the flame against a firebrick surface in the fire chamber. 5. We were much interested in your article on oil burners, but you did not give the furnace phase of the question. It will interest thousands of your readers. What burners are best adapted for such? A. There are a number of oil burners on the market which must be operated by steam or air pressure. 6. I have looked through shelf after shelf of engineering works, yet find no tabular schedule of atmospheric pressure, barometric height, altitude and boiling temperature. A. "Compressed Air and Its Applications," by Hiscox, contains a full table of barometric heights and boiling temperature of water (page 38); $5 by mail. 7. As pressure exceeds normal, is the temperature of water the same as the steam? A. Yes. 8. When the steam gage shows pressure of 1 pound, does it not mean 1 pound *above atmospheric?* A. Yes. 9. According to all formulæ of heating, it seems to me a mathematical certainty that shutting off radiators in unused apartments economizes fuel in just the ratio of such cubic space or radiating surface. Yet I find men who contend there is no economy. My experience is in accordance with my belief and formulæ. A. Our experience is in the line of economy from closing radiators when not needed.

(10407) O. L. C. writes: Please see Not 7 and Queries 10342. If reasoning there is correct, a hollow paper globe filled with hydrogen will fall as fast as a solid leaden sphere. The work-power to accelerate velocity and remove air depends on weight of body only. Since the resistance is the same, and the weight, therefore work-power, of lighter body is less, it must fall slower. The SCIENTIFIC AMERICAN is valuable, but not infallible. A. It is so evident that the answer to Query 10342 is incomplete that it is also surprising to receive so many criticisms on the matter. It is only necessary to say that the difference between free fall and a fall against the resistance of the air is not apparent for balls of lead and aluminium until a fall of about 100 feet is reached. Our authority for the statement is Mayer's "Mechanics," page 33. For all falls through short distances, the answer to which objection is made is practically correct. We, however, cheerfully admit that we are not infallible. not so infallible as our critics.

(10408) C. H. W. writes: I have for many years been reading with much pleasure and profit your answers to the varied questions that are addressed to you, and have learned to rely on them fully. Great is my surprise, therefore, to read, in Query 10342, your statement that "the two spheres of the same size" [but of different weights] "will fall through a given height in the same time." It would be easy to show, mathematically, the falsity of this conclusion, but a more direct way would be a resort to experiment. If your principle holds good, a toy balloon, or even a soap bubble, would reach the earth from a given height at the same time as say a croquet ball of the same size. Try it. Or, if you prefer a rather more elegant experiment, make two pendulums of the same length with spherical bobs of just the same size, but one of wood and the other of lead, and start them swinging together and see if they will finally come to rest at the same time, as they should do on your theory. But enough; excuse my friendly criticism. A. The answer to Query 10342, to which your letter refers, by some oversight was inserted without the qualifying statement as to what height two metal balls may be dropped without separating perceptibly in their fall. It is stated by Mayer to be about 200 feet. See his "Principles of Elementary Mechanics," page 33, at foot of page. Your confidence in us might have led you to say that something had been omitted rather than to charge an error so swiftly. We have had much experience in teaching physics for nearly forty years, and are still in the harness. What you say about a soap bubble is hardly to the point. Lead and aluminium are more nearly alike in density than are lead and air. Dense metallic balls do not deviate from free fall perceptibly for quite a distance, say 100 to 200 feet. See Mayer as above. This question has been up many times. It seems to be always up. The literature of it in our query column is quite extensive. See Queries 9679, 9756, 9804, 9840, 9873, 9879. There have been others, but we do not have the references just now. These are within two years.

(10409) E. L. C. asks: 1. If a vessel sinks in five miles of water, will she go to the bottom? If not, why? I think she will; the others think not. A. If a vessel begins to sink, it must continue to sink till it reaches the bottom. If it is compressed by the pressure of the water as it goes down deeper and deeper, it becomes still heavier with reference to the water than it was at the surface, and at the surface it was heavy enough to sink. At greater depths it will be able to sink faster, since the water is not compressed to any extent at greater depths than it is near the surface. If anything can sink at all in water, it will go to the bottom before it stops. 2. If a man gets into a tank of water resting upon a pair of scales, and floats upon the water, will the scales register the man's exact weight in addition to the weight of the tank and water? Will it make any difference whether he floats or lets himself sink? The tank sides are high enough, so that no water can overflow. A. The balances will show the weight of the man in addition to the weight of the tank and the water. When the man gets into the water, the water rises in the tank; that is, it becomes deeper. It is exactly the same as if more water were poured into the tank. No one would doubt that the scales would show more weight if 100 pounds of water were put into the tank. Why not when 100 pounds of man are put in? This question has traveled for a century in various forms around the world.

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