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Consumers and/or structural defects in diamonds are caused a dramatic drop in the price of mined diamonds and an industry crisis, with mines and polishing facilities closing or suspending production.[31][32][33] The most familiar usage of diamonds today is as gemstones used for adornment—a usage which dates back into antiquity. The dispersion of white light into spectral colors is the primary gemological characteristic of diamonds. In the twentieth century, gemologists have developed methods of grading diamonds and other gemstones based on their value as a gem. Our characteristics most important to their value as a gem, our characteristics most commonly known informally as the "four Cs", are color, clarity, cut, and carat.[34] This system was developed by Gemological Institute of America in 1953 as internationally recognized standard to evaluate diamonds' characteristics. Most gem diamonds are traded on the wholesale market based on single values for each of the four Cs; for example knowing that a diamond is rated as 1.5 carats (300 mg), VS2 clarity, F color, excellent cut round brilliant, is enough to reasonably estimate an expected price range. More detailed information from within each characteristic is used to determine actual market value for individual stones. Consumers who purchase individual diamonds are often advised to use the four Cs to pick the diamond that is "right" for them. Other characteristics also influence the value and appearance of a gem diamond. These include physical characteristics such as the presence of fluorescence as well as the diamond's source and which gemological institute evaluated the diamond. Cleanliness also dramatically affects a diamond's beauty. There are two major non-profit gemological associations which grade and provide reports, (informally referred to by the term certificate or cert, which is a misnomer for many grading reports) on diamonds; while carat weight and cut angles are mathematically defined, the clarity and color are judged by the trained human eye and are therefore open to slight variance in interpretation. These associations are listed below. Gemological Institute of America (GIA) was the first laboratory in America to issue modern diamond reports.[35] and is held in high regard amongst gemologists for its consistent, conservative grading. Diamond High Council (HRD) Official certification laboratory of the Belgian diamond industry, located in Antwerp.[36] Within the last two decades, a number of for-profit gemological grading laboratories have also been established, many of them also based in Antwerp or New York. These entities serve to provide similar services as the non-profit associations above, but in a less expensive and more timely fashion. They produce certificates that are similar to those of the GIA. The carat weight measures the mass of a diamond. One carat is defined as 200 milligrams (about 0.007 ounces avoirdupois). The point unit equals one hundredth of a carat (0.01 carat, or 2 mg)—is commonly used for diamonds less than one carat. All else being equal, the price per carat increases with carat weight, since larger diamonds are both rarer and more desirable for use as gemstones. The price per carat does not increase linearly (proportionally) with increasing size. Instead, there are sharp jumps around milestone carat weights, as demand is much higher for diamonds weighing just more than a milestone than for those weighing just less. As an example, a 0.99-carat diamond may have a significantly lower price per carat than a comparable 1.01-carat diamond, because of differences in demand. A weekly diamond price list, the Rapaport Diamond Report is published by Martin Rapaport, CEO of Rapaport Group of New York, for different diamond cuts, clarity and weights.[37] It is considered the de facto retail price baseline.[by whom?] Jewelers often trade diamonds at negotiated discounts off the Rapaport price (e.g., "R−3%"). In the wholesale trade of gem diamonds, carat is often used in denominating lots of diamonds for sale. For example, a buyer may place an order for 100 carats (20 g) of 0.5-carat (100 mg), D-F, VS2-SI1, excellent cut diamonds, indicating a wish to purchase 200 diamonds (100 carats (20 g) total mass) of those approximate characteristics. Because of this, diamond prices (particularly among wholesalers and other industry professionals) are often quoted per carat, rather than per stone. Total carat weight (t.c.w.) is a phrase used to describe the total mass of diamonds or other gemstone in a piece of jewelry, when more than one gemstone is used. Diamond solitaire earrings, for example, are usually quoted in t.c.w. when placed for sale, indicating the mass of the diamonds in both earrings and not each individual diamond. t.c.w. is also widely used for diamond necklaces, bracelets and other similar jewelry pieces. Main article: Diamond clarity Clarity is a measure of internal defects of a diamond called inclusions. Inclusions may be crystals of a foreign material or another diamond crystal, or structural imperfections such as tiny cracks that can appear whitish or cloudy. The number, size, color, relative location, orientation, and visibility of inclusions can affect the relative clarity of a diamond. The Gemological Institute of America (GIA) and other organizations have developed systems to grade clarity, which are based on those inclusions which are visible to a trained professional when a diamond is viewed under 10x magnification. Diamonds become increasingly rare when considering higher clarity gradings. Only about 20% of all diamonds mined have a clarity rating high enough for the diamond to be considered appropriate for use as a gemstone; the other 80% are relegated to industrial use. Of that top 20%, a significant portion contains one or more visible inclusions. Those that do not have a visible inclusion are known as "eye-clean" and are preferred by most buyers, although visible inclusions can sometimes be hidden under the setting in a piece of jewelry. Most inclusions present in gem-quality diamonds do not affect the diamonds' performance or structural integrity. When set in jewelry, it may also be possible to hide certain inclusion behind mounting hardware such as prongs in a way that renders the defect invisible. However, large clouds can affect a diamond's ability to transmit and scatter light. Large cracks close to or breaking the surface may increase the likelihood of a fracture. Diamonds are graded by the major societies on a scale ranging from flawless to imperfect. Main article: Diamond color Jewelers sometimes set diamonds in groups of similar colors. The Darya-I-Nur Diamond The finest quality of any color grading is totally colorless, which is graded as D color diamond across the globe, meaning it is absolutely free from any color. The next grade has a very slight trace of color, which can be observed by any expert diamond valuer/grading laboratory. However, when studied in jewellery these very light colored diamonds do not show any color or it is not possible to make out color shades. These are graded as E color or F color diamonds. Diamonds which show very little traces of color are graded as G or H color diamonds. Slightly colored diamonds are graded as I or J or K color. A diamond can be found in any color in addition to colorless. Some of the colored diamonds, such as pink, are very rare. A chemically pure and structurally perfect diamond is perfectly transparent with no hue, or color. However, in reality most gem-sized natural diamonds are imperfect. The color of a diamond may be affected by chemical impurities and/or structural defects in the crystal lattice. Depending on the hue and intensity of a diamond's coloration, a diamond's color can either detract from or enhance its value. For example, most white diamonds are discounted in price as a more yellow hue is detectable, while intense pink or blue diamonds (such as the Hope diamond) can be dramatically more valuable. The Aurora Diamond Collection displays a spectacular array of naturally colored diamonds, which occur in every color of the rainbow.[38][39] Most diamonds used as gemstones are basically transparent with little tint, or white diamonds. The most common impurity, nitrogen, replaces a small proportion of carbon atoms in a diamond's structure and causes a yellowish to brownish tint.[40] This effect is present in almost all white diamonds; in only the rarest diamonds is the coloration from this effect undetectable. The GIA has developed a rating system for color in white diamonds, from D to Z (with D being "colorless" and Z having a bright yellow coloration), which has been widely adopted in the industry and is universally recognized, superseding several older systems. The GIA system uses a benchmark set of natural diamonds of known color grade, along with standardized and carefully controlled lighting conditions. Diamonds with higher color grades are rarer, in higher demand, and therefore more expensive, than lower color grades. Oddly enough, diamonds graded Z are also rare, and the bright yellow color is also highly valued. Diamonds graded D-F are considered "colorless", G-J are considered "near-colorless", K-M are "slightly colored". N-Y usually appears light yellow or brown. In contrast to yellow or brown hues, diamonds of other colors are more rare and valuable. While even a pale pink or blue hue may increase the value of a diamond, more intense coloration is usually considered more desirable and commands the highest prices. A variety of impurities and structural imperfections cause different colors in diamonds, including yellow, pink, blue, red, green, brown, and other hues. There is also a kind of pebble containing polycrystalline diamond that is black or gray, called carbonado, which may be of extraterrestrial origin. It is the toughest form of diamond and is used as an abrasive, though sometimes also as precious stone[41] (for example The Enigma). Diamonds with unusual or intense coloration are sometimes labeled "fancy" in the diamond industry. Intense yellow coloration is considered one of the fancy colors, and is separate from the color grades of white diamonds. Gemologists have developed rating systems for fancy colored diamonds, but they are not in common use because of the relative rarity of such diamonds.[42] Main article: Diamond cut Diamond cutting is the art and science of creating a gem-quality diamond out of mined rough. The cut of a diamond describes the manner in which a diamond has been shaped and polished from its beginning form as a rough stone to its final gem proportions. The cut of a diamond describes the quality of workmanship and the angles to which a diamond is cut. Often diamond cut is confused with "shape". There are mathematical guidelines for the angles and length ratios at which the diamond is supposed to be cut in order to reflect the maximum amount of light. Round brilliant diamonds, the most common, are guided by these specific guidelines, though fancy cut stones are not able to be as accurately guided by mathematical specifics. The techniques for cutting diamonds have been developed over hundreds of years, with perhaps the greatest achievements made in 1919 by mathematician and gem enthusiast Marcel Tolkowsky. He developed the round brilliant cut by calculating the ideal shape to return and scatter light when a diamond is viewed from above. The modern round brilliant has 57 facets (polished faces), counting 33 on the crown (the top half), and 24 on the pavilion (the lower half). The girdle is the thin middle part. The function of the crown is to refract light into various colors, and the pavilion's function is to reflect light back through the top of the diamond. [43] Tolkowsky's calculations included some approximations. He calculated the ideal dimensions as: Table percentage (corner-to-corner diameter of the table divided by overall diameter) = 53% Depth percentage (overall depth divided by overall diameter) = 59.3% (not including adjustments for the culet height and girdle thickness) Pavilion angle (angle between the girdle and the pavilion main facets) = 40.75° Crown angle (angle between the girdle and the crown's kite facets) = 34.5° Pavilion depth (depth of pavilion divided by overall diameter) = 43.1% Crown depth (depth of crown divided by overall diameter) = 16.2% The culet is the tiny point or facet at the bottom of the diamond. The angle between the culet and the pavilion facets is 170°. Tolkowsky's calculations included neither a culet nor a girdle. However, a girdle is required in reality in order to prevent the diamond from easily chipping in the setting. The thick part of the girdle is normally about 1.7% (of the overall diameter) thicker than the thin part of the girdle.[43] The further the diamond's characteristics are from the Tolkowsky's ideal, the less light will be reflected. However, there is a small range in which the diamond can be considered "ideal". Tolkowsky's calculations can be repeated for a narrow range of pavilion angles. Such calculations show a slightly larger table percentage, and a trade-off between pavilion angle and crown angle.[43] Today, because of the relative importance of carat weight among buyers, many diamonds are often intentionally cut poorly to increase carat weight. There is a financial premium for a diamond that weighs the desirable 1.0 carat (200 mg), so often the girdle is made thicker or the depth is increased. Neither of these changes makes the diamond appear any larger, and both greatly reduce the sparkle of the diamond. (A poorly cut 1.0-carat (200 mg) diamond may have the same diameter and appear as large as a 0.85-carat (170 mg) diamond.) The depth percentage is the overall quickest indication of the quality of the cut of a round brilliant. "Ideal" round brilliant diamonds should not have a depth percentage greater than 62.5%. Another quick indication is the overall diameter. Typically a round brilliant 1.0-carat (200 mg) diamond should have a diameter of about 6.5 mm (0.26 in). Mathematically, the diameter in millimeters of a round brilliant should approximately equal to 6.5 times the cube root of carat weight, or 11.1 times the cube root of gram weight, or 1.4 times the cube root of point weight. Diamonds do not show all of their beauty as rough stones; instead, they must be cut and polished to exhibit the characteristic fire and brilliance that diamond gemstones are known for. Diamonds are cut into a variety of shapes that are generally designed to accentuate these features. Diamonds which are not cut into a round brilliant shape are known as "fancy cuts". Popular fancy cuts include the baguette (French, meaning rod or loaf of bread), marquise, princess cut (square outline), heart, broliette (a form of the rose cut), and pear cuts. Newer cuts that have been introduced into the jewelry industry are the "cushion" "radian" (similar to princess cuts, but with rounded edges instead of square edges) and Asscher cuts. Many fancy colored diamonds are now being cut according to these new styles. Generally speaking, these "fancy cuts" are not held to the same strict standards as Tolkowsky-derived round brilliants and there are less specific mathematical guidelines of angles which determine a well-cut stone. Cuts are influenced heavily by fashion: the baguette cut—which accentuates a diamond's luster and downplays its fire—was popular during the Art Deco period, whereas the princess cut—which accentuates a diamond's fire rather than its luster—is currently gaining popularity. The princess cut is also popular amongst diamond cutters: of all the cuts, it wastes the least of the original crystal. The past decades have seen the development of new diamond cuts, often based on a modification of an existing cut. Some of these include extra facets. These newly developed cuts are viewed by many as more of an attempt at brand differentiation by diamond sellers, than actual improvements to the state of the art.[43] The quality of a diamond's cut is widely considered the most important of the four Cs in determining the beauty of a diamond; indeed, it is commonly acknowledged that a well-cut diamond can appear to be of greater carat weight, and have clarity and color appear to be of better grade than they actually are. The skill with which a diamond is cut determines its ability to reflect and refract light. In addition to carrying the most importance to a diamond's quality as a gemstone, the cut is also the most difficult to quantitatively judge. A number of factors, including proportion, polish, symmetry, and the relative angles of various facets, are determined by the quality of the cut and can affect the performance of a diamond. A diamond with facets cut only a few degrees out of alignment can result in a poorly performing stone. For a round brilliant cut, there is a balance between "brilliance" and "fire". When a diamond is cut for too much "fire", it looks like a cubic zirconia, which gives off more "fire" than a real diamond. A well-executed round brilliant cut should reflect light upwards and make the diamond appear white when viewed from the top. An inferior cut will produce a stone that appears dark at the center and in extreme cases the setting may be seen through the diamond as shadowy. Several different theories on the "ideal" proportions of a diamond have been and continue to be advocated by various owners of patents on machines to view how well a diamond is cut. These advocate a shift away from grading cut by the use of various angles and proportions towards measuring the performance of a cut stone. A number of specially modified viewers and machines have been developed toward this end. 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