

Catalogue of borderline cases between articles and substances/mixtures

May 2025

ABC

Disclaimer

The catalogue of borderline cases of substances in articles is a compilation of cases agreed by the members of the Working group on borderline cases of substance in articles (BWG), consisting of representatives of the HelpNet, the Forum and the ECHA Secretariat.

The aim of the catalogue is to help authorities and duty-holders to reach conclusions on the assessment of borderline cases of substances in articles. However, users are reminded that the text of the REACH Regulation **is the only authentic legal reference** and that the information in this document does not constitute legal advice. Usage of the information remains under the sole responsibility of the user. The European Chemicals Agency does not accept any liability with regard to the use that may be made of the information contained in this document.

The catalogue should be regarded as a 'living' document. It is not exhaustive and further cases and assessments will be added over time, as they are agreed upon by the BWG members.

| Version | Changes | Date |
|-----------|--|--------------|
| Version 1 | First edition | March 2023 |
| Version 2 | <p>Introduction of new cases:</p> <ul style="list-style-type: none"> · Leca nuts – link to overview · Silver catalyst – link to overview · Metal soap made of stainless steel – link to overview · Insulated wire – link to overview · Cable with insulated wires – link to overview <p>This example also shows a proposal to calculate the concentration of a Candidate List substance in the electrical cable – link to detailed assessment</p> <ul style="list-style-type: none"> · Match and safety match – link to overview · Sparkler – link to overview · Pocket lighter – link to overview · Cavity sealing systems – link to overview · Fire protection putty – link to overview | October 2023 |
| Version 3 | <p>Introduction of new cases:</p> <ul style="list-style-type: none"> · Reusable cold or warm pack filled with same phase and phase-transition content – link to overview · Single-use (“instant”) cold pack – link to overview · Heat patch of pack – link to overview · Lubricants in engines and grease/oil on vehicle component/ lubricant on the steel cable – link to overview · Air freshener for cars – link to overview | May 2024 |
| Version 4 | <p>Minor editorial reviews</p> <ul style="list-style-type: none"> · Reusable cold or warm pack filled with same phase and phase-transition content – link to overview · Heat patch of pack – link to overview · Lubricants in engines and grease/oil on vehicle component/ lubricant on the steel cable – link to overview · Air freshener for cars – link to overview <p>Introduction of new cases:</p> <ul style="list-style-type: none"> · Glitter – link to overview · Recycled mattress pad – link to overview · Low carbon steel shots – link to overview · Objects similar to the pocket lighter: <ul style="list-style-type: none"> ○ camping gas stove – link to overview ○ kitchen stove with gas burners – link to overview ○ gas barbecue/grill – link to overview | May 2025 |

If you have questions or comments in relation to this document, please send them (quote the reference and issue date) using the information request form. The information request form can be accessed via the Contact ECHA page at:
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1. Introduction

The Borderline Working Group was established in March 2021 under the HelpNet Steering Group with representatives of the REACH national helpdesks, Enforcement Forum members and ECHA. Its objectives are to:

- discuss difficult questions received by national helpdesks and ECHA on borderline cases between substances/mixtures and articles; and
- create a catalogue of detailed borderline substances/mixtures versus articles case assessments.

This document aims to assist users to determine whether an object fulfils the REACH article definition (REACH Article 3(3)) and only expresses the views of the authors.



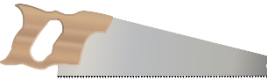


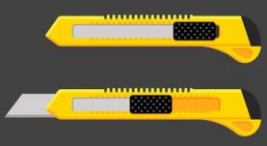
The assessments are carried out on a case-by-case basis and follow the guidelines of Chapter 2 of the *Guidance on requirements for substances in articles* (available from the [ECHA Guidance on REACH page](#)).





The detailed assessments and conclusions only apply to the identified and described objects. It does not necessarily mean that the assessment of similar objects would lead to the same conclusions. The description aims to clarify the particular object being assessed.






The objective of the catalogue is not only to document specific cases but also to find common elements among them. This allows for an evaluation of the potential for applying similar reasoning to other comparable cases. Suggestions for similar cases are provided as notes under the object name in the 'Object' column of the overview of agreed assessment of the borderline case between article and substance/mixture.


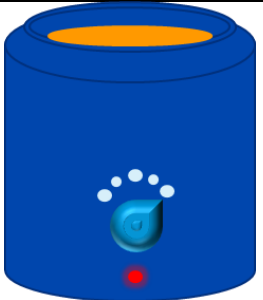

2. Overview of agreed borderline cases






Table 1: Overview of agreed borderline cases

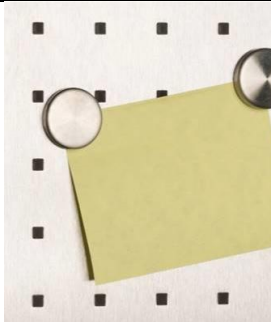


| Object | Picture | Description | Conclusion | Detailed assessment |
|---|--|--|------------|----------------------|
| Drill bit |  Figure 1: Twist drill bit | A twist drill bit is an item made from a sturdy material (usually metal) and shaped in a way that enables it to drill holes when rotating in objects made of different materials. It is a rotating cutting tool. | Article | Link |
| [Note: similar objects Chisel and scraper blades | [Note: similar objects]  Figure 2: Chisel blade | | | |
| Saw blade |  Figure 3: Saw blade | | | |
| Rasp blade |  Figure 4: Rasp blade | | | |
| Knife blade |  Figure 5: Knife blade | | | |
| Retractable blade] |  Figure 6: Retractable blade | | | |

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| <p>Water-soluble plastic foil bag (to enclose a content)</p> |  <p>Figure 7: Water soluble film pouch (to enclose a content)</p> | <p>A water-soluble plastic foil bag is used to enclose a liquid or a solid.</p> <p>When used, in contact with water, the water-soluble plastic foil bag dissolves and releases the contents.</p> | <p>Article</p> | <p>Link</p> |
| <p>Water soluble foil bag with content (e.g. water-soluble tablets)</p> |  <p>Figure 8: Water soluble foil bag with solid and liquid content</p>  <p>Figure 9: Water soluble dishwashing tablets</p> | <p>The water-soluble plastic foil bag, enclosing a liquid or a solid content, dissolves when in contact with water and as a consequence breaks and releases its content.</p> <p>There are several types of such objects, the most common being water-soluble dishwashing tablets.</p> | <p>Combination of an article and a substance /mixture</p> | <p>Link</p> |
| <p>Reusable cold or warm pack filled with same phase and phase-transition content</p> |  <p>Figure 10: Freezer ice packs</p> | <p>Portable closed container enclosing a content (e.g. water, aqueous liquid mixture, gel, or other liquid) to provide cooling and warming (or both). The content may undergo phase transition or not.</p> | <p>Combination of a substance / mixture and a container or bag (article)</p> | <p>Link</p> |

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| |  <p>Figure 11: Reuseable cold pack</p>  <p>Figure 12: Cold and warm gel compress</p>  <p>Figure 13: Ice pack with velcro wrap</p> <p>[Note: similar objects Ice pack; Ice bag; Cold pack; Warm/cold compress (or pack)]</p> | | | |
| Single-use ("instant") cold pack |  <p>Figure 14: Icepack - single use instant cold pack</p> | <p>Portable external closed bag enclosing a fluid, often water, and an inside bag containing a substance or mixture. Once the inside bag is broken by squeezing the package, the substance or mixture is released and reacts with the fluid through a endothermic chemical reaction (dissolution)</p> | <p>Combination of substances or mixtures and containers or bags (articles)</p> | Link |
| Heat patch or pack |  <p>Figure 15: hand</p> | <p>Portable air-permeable bag which is air-activated to provide warming. The activation is usually performed by removing a protective plastic film, which allows oxygen from the air to penetrate the bag.</p> | <p>Combination of a mixture/substance and a container or bag (article)</p> | Link |




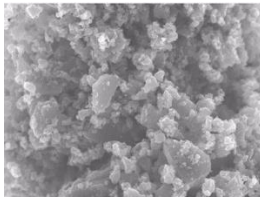
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| | warmers | Some may contain two compartments. After the barrier ruptures the content of the 2 compartments mix producing heat through an exothermic chemical reaction. | | |
| Wax of an electronic candle (flameless) for decoration |  <p>Figure 16: Electronic candle</p> | <p>A decorative object.</p> <p>The (paraffin) wax hull is shaped in the form of a candle.</p> <p>It houses a lamp (and other electric components), which illuminates and works as a heating source, while the object is flameless.</p> <p>There is no combustion and no wax consumption.</p> <p>If the candle contains a fragrance infused into the paraffin wax, released as the wax warms up (the wax does not melt), the object is an article with 'a substance intended to be released'.</p> | Article | Link |
| <p>Electronic wax "melter" (flameless)</p> <p>[Note: similar objects Electric room freshener (diffuser) Electric insecticide (diffuser)]</p> |  <p>Figure 17: Electronic wax melter</p>  <p>Figure 18: Electric diffuser</p> | <p>The electronic wax "melter" is an air freshener (diffuser) and often a decorative object. The wax "melter" houses an electronic heating source or melter, e.g. a lamp, and a compartment with paraffin wax infused with a fragrance.</p> <p>This type of electronic wax "melter" is used to melt wax containing a fragrance to release the fragrance for scenting purposes.</p> <p>The molten wax is removed and replaced by new wax after all fragrance has been released.</p> | Combination of an complex object and a mixture | Link |





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| <p>Air freshener for cars</p> <p>[Note: similar objects Refillable air fresheners for cars]</p> |  <p>Figure 19. Car air freshener</p>  <p>Figure 20: air freshener for car</p> | <p>Air freshener for cars is an object that releases a fragrance. It is usually used inside of vehicles.</p> <p>In the case reviewed, the system is a passive non-mechanical evaporating scent diffuser.</p> | <p>Combination of an article (functioning as a carrier) and a substance / mixture (fragrance)</p> | <p>Link</p> |
| <p>Coated electronic wax candle</p> |  <p>Figure 21: Coated electronic wax candles</p> | <p>The wax is shaped in the form of a candle (see 'Wax of an electronic candle') and is coated.</p> <p>Furthermore, the object contains a lamp (and other electric components), which illuminates and works as a heating source, therefore, it is flameless. There is no combustion and no wax consumption.</p> | <p>Article (coated article)</p> | <p>Link</p> |
| <p>Coated conventional candle</p> |  <p>Figure 22: Burning candle</p> | <p>Moulded or dipped mass of wax or tallow containing a wick that may be burned. The wax or tallow is coated.</p> | <p>Combination of an article (wick) and a mixture (wax and coating)</p> | <p>Link</p> |
| <p>Lubricants in engines and grease/oil on vehicle component/ lubricant on the steel cable</p> |  <p>Figure 23: Engine Oil</p> | <p>Dense, liquid substance used for lubricating an engine or components, such as oil or grease. Can be used to prevent corrosion during transport and storage. However, the lubricated articles or complex objects do not change their function by incorporating the lubricant.</p> | <p>Integral part of the article</p> | <p>Link</p> |

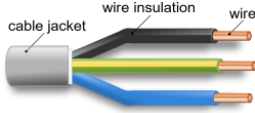




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| Permanent magnets |  <p>Figure 24: Note on magnetic board</p> | <p>Permanent magnets are manufactured in different sizes and forms depending on their specific applications.</p> <p>The materials to be used to produce permanent magnets must either be materials with permanent magnetic fields or materials with a susceptibility to be magnetised by applying an external magnetic field.</p> | Substance/ mixture | Link |
| Plastic or rubber granules (as infill material for sports pitches and playgrounds) |  <p>Figure 25: Artificial turf surface</p> | <p>Plastic or rubber granules are used as soft infill materials to make sports pitches and playgrounds.</p> <p>The rubber granules are often made from end-of-life tyres (ELTs) that are broken up and ground into smaller pieces. The plastic granules result from shredded plastic objects.</p> | Substance/ mixture | Link |
| LECA nuts |  <p>Figure 26: Leca nuts</p> | <p>For LECA (lightweight expanded clay aggregate) production, clay is extracted and introduced to rotary kilns. These kilns are heated to temperatures 1100–1300 °C. As it is fired, the organic compounds in the clay burn off, forcing the pellets to expand and become honeycombed while the outside surface of each granule melts and is sintered. The resulting nuts are lightweight, porous and have a high crushing resistance.¹</p> <p>LECA nuts have a rounded shape due to the movement in the kiln. They are produced in different sizes and densities.</p> <p>They are used in a variety of applications, namely in the manufacture of lightweight concrete, concrete blocks and slabs, geotechnical fillings,</p> | Substance/ mixture | Link |



¹ References:

E.g. A. M. Rashad, Constr. Build. Mater. 170 (2018) 757-775;
E. Roces et al. Constr. Build. Mater. 313 (2021) 125486;
S. Schiavoni et al. Renew. Sustain. Energy Rev. 62 (2016) 988–1011;
B. B. Mathew et al. J. Toxicol. 2016 (2016) 4369604.

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| | | insulation materials, and gardening. | | |
| Low carbon steel shots |  <p>Figure 27: steel abrasive media</p> | <p>Low carbon steel shot is produced using low-carbon scrap, which is well selected and contains sulphur and phosphorus.</p> <p>In the formulation process, scrap is melted in induction furnaces at 1600-1650 °C, cooled in water after atomisation and has a bainite microstructure. Low carbon steel shot particles are obtained in the form of cracks-free grains.</p> | Mixture | Link |
| Glitter |  <p>Figure 28: Glitter containers</p>  <p>Figure 29: Glitter in different colours</p> | <p>Collection of small and reflective particles produced in various shapes, sizes and colours.</p> | Substance / mixture | Link |
| Silver / aluminium oxide catalyst |  <p>Figure 30: conventional catalyst</p> | <p>The silver/aluminium oxide (Ag/Al₂O₃) catalyst is manufactured by binding silver particles to a porous aluminium oxide pellet (support). The silver particles in the catalyst pellet are strongly bonded to the surfaces of the porous aluminium oxide support and cannot be separated from the support during intended use to release silver powder. The silver particles can be recovered and recycled from the catalyst after it is discharged at end of life from the reactor.</p> <p>The silver catalyst is specially manufactured to consist of a support (substrate) material (porous aluminium oxide pellets) with the silver particles on the external surface and internal porous</p> | Substance / mixture | Link |

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| | | surfaces, bound via chemical reactions and/or physicochemical interactions. The resulting silver/aluminium oxide (Ag/Al ₂ O ₃) catalyst particle, characteristically, has numerous catalytic active sites on the whole available surface of the support material and a high surface to volume ratio due to the porosity of the carrier. The catalyst particle contains a relevant active substance/moiety distributed over all the accessible surface area, i.e. external surface and internal porous surfaces. | | |
| Pyrotechnic inflator of an airbag system |  <p>Figure 31: Car interior with used airbag system</p> | <p>In the event of a collision, the pyrotechnic material in the inflator is ignited and gases are produced or released which inflate the airbag.</p> <p>The airbag system is a complex object. Within the airbag system, there is the inflator that contains a pyrotechnic mixture, the propellant (chemical composition is highly important) that, upon a trigger/ignition, releases gases immediately.</p> | Combination of articles and a mixture | Link |
| 3D printing filament used as thermo-plastic raw material for 3D-printers |  <p>Figure 32: 3D-printing filaments</p> | <p>Thermoplastic is the raw material for fused deposition modelling 3D-printers.</p> <p>There are many types of filaments available, with different properties, requiring different temperatures for printing.</p> | Substance/mixture | Link |
| Soldering or welding metal wire |  <p>Figure 33: Welding</p> | <p>Soldering and welding wires are metal alloys manufactured with the profile of a wire.</p> <p>They are used for welding or soldering, i.e. to join two or more items.</p> | Mixture (alloy) | Link |
| Electric insulated wire |  <p>Figure 34: Insulated wire (insulation applied by extrusion of melted insulating material)</p> | The insulated wire is produced by "applying" a melted insulated material (mixture) to the metal wire, e.g. through extrusion over the metal core wire (no shrink-on tube). | Article with an insulating substance/mixture | Link |

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| <p>Electrical cable with insulated wires</p> |  <p>Figure 35: Insulated wires coated with a cable jacket that was incorporated by extrusion</p>  <p>Figure 36: Electric guide (electric wire) 3x2.5 mm (diameter)</p> | <p>The melted material is extruded onto the insulated wires to make the protective jacket. The inner insulated wires act as an internal mould for the jacket.</p> <p>The cable is a complex object made of two or more insulated wires protected by a cable's jacket.</p> <p>The jacket layer may be peeled off by electrician to reveal inner wires.</p> | <p>Complex object made of two or more articles</p> <p><i>Note: the detailed assessment also shows a proposal to calculate the concentration of a Candidate List substance in the electrical cable.</i></p> | <p>Link</p> |
| <p>Glow stick</p> |  <p>Figure 37: Glow stick</p> | <p>A glow stick consists of a closed glass tube in a plastic container. The glass tube contains a liquid and is surrounded by another liquid in the plastic container. When the inner glass tube is cracked, both liquids react producing chemiluminescence (light).</p> | <p>Combination of articles (containers) and mixtures</p> | <p>Link</p> |
| <p>Match and safety match</p> |  <p>Figure 38: Match</p> | <p>A match is made of a small wooden stick or stiff paper, coated at one end with a flammable or oxidising substance or mixture that can be ignited. The ignition takes place by applying friction, i.e. when scratching or striking the flammable solid against a suitable surface.</p> | <p>Combination of a carrier and a substance/mixture</p> | <p>Link</p> |
| <p>Sparkler</p> |  <p>Figure 39: Sparkler</p> | <p>A sparkler consists in a thin metallic wire covered with a solid layer which, after being ignited, undergoes exothermic chemical reactions that produce light on the surface and by emitting bright coloured sparks. Often, they also produce other effects (e.g. smoke and sound).</p> <p>Sparklers are generally made around a thin non-combustible metallic wire that has been dipped into a mixture and allowed to dry.</p> | <p>Combination of a carrier (article) and a solid energetic mixture</p> | <p>Link</p> |

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| | | <p>The solid layer around the metal wire commonly contains²:</p> <ul style="list-style-type: none"> - an oxidiser, - a metallic component (to make sparks), - a combustible binder, - a fuel component, - and regulators/colourants. | | |
| Pocket lighter |  <p>Figure 40: Pocket lighter</p> | <p>A pocket lighter is a portable device which generates and sustains a flame.</p> <p>It consists of a container (e.g. plastic or metal) filled with a flammable liquid or compressed gas (fuel). It usually incorporates a means to ignite the fuel, a means for extinguishing the flame, and a controlled release set-up for the fuel.</p> | Combination of articles (container and controlled release set-up) and a substance/mixture (fuel) | Link |
| <p>[Note: similar objects]</p> <p>Camping gas stove</p> |  <p>Figure 41: camping gas stove</p> | | | |




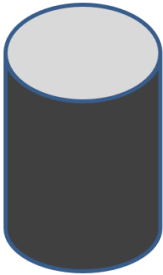
² Reference examples:






M. Scheid et al. Chem. Teacher Int. (2021) 3, 285–294;



M. Remškar et al. Air Qual. Atmos. Health (2015) 8, 205–211



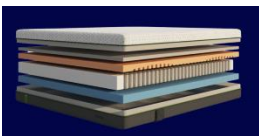
<https://www.chemie.de/infografiken/179/the-chemistry-of-sparklers.html>

<https://www.mcgill.ca/oss/article/technology-you-asked-general-science/how-do-sparklers-work>

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| <p>Kitchen stove with gas burners</p> <p>Gas barbecue/grill]</p> |  <p>Figure 42: Gas stove flame</p>  <p>Figure 43: gas stove</p>  <p>Figure 44: gas barbecue/grill</p> | | | |
| <p>Heat source for tobacco products, based on a chemical reaction</p> |  <p>Figure 45: Heat source for tobacco products based on a chemical reaction</p> | <p>The heat source is made of a powder mixture of charcoal, calcium peroxide and, to a small extent, binders. The powder is formed into a cylinder from moist agglomerates.</p> <p>The cylinders are given a specific shape that is precisely matched to the end-product.</p> <p>A metal foil is attached to this object on one of the flat sides, which ensures that the heat-generating part of the product is shielded from the tobacco in the end-product and thus prevents the generated heat from burning the tobacco instead of just heating it.</p> | <p>Combination of an article (foil) and a mixture (charcoal and additives)</p> | <p>Link</p> |

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| <p>Standard gold bar (or gold bullion or gold ingot)</p> |  <p>Figure 46: Gold bar</p> | <p>A gold bar (also called gold bullion or gold ingot) is a piece, usually a bar, of refined metallic gold (Au).</p> <p>A standard gold bar of specific gold purity and weight is held by central banks as gold reserves and held by private citizens and companies for investment.</p> | <p>Substance</p> | <p>Link</p> |
| <p>Perforated disk metal coffee filter (nonwoven)</p> <p>[Note: similar object funnel/cone-shaped metal coffee filter]</p> |  <p>Figure 47: Perforated disk metal coffee filter</p>  <p>Figure 48: Funnel metal coffee filter</p> | <p>Perforated reusable metal coffee filters are available and are often used in certain coffee machines and other coffee maker devices.</p> <p>A non-woven metal perforated filter can be produced by perforating and cutting a suitable thin metal sheet, or by using other fabrication techniques.</p> <p>Despite the common name being coffee “filter”, it works as a sieve – straining solids from a fluid in a single screen layer or barrier.</p> <p>This example does not cover filters made from cloths or meshes of metal wires or filaments.</p> | <p>Article</p> | <p>Link</p> |
| <p>Porous transversal (micro) filtration membrane</p> |  <p>Figure 49: Transversal filtration membrane</p>  <p>Figure 50: Transversal microfiltration membrane within a microfiltration device</p> | <p>A porous transversal (micro)filtration membrane is used for filtration – the separation of matter from other matter (e.g. in solutions, emulsions, and suspensions) through a multilayer lattice of an interposing medium.</p> <p>Porous transversal (micro)filtration membranes have a large number of applications, where the feed flows transversally through the membrane (from upper surface to lower surface of the multilayer lattice of the membrane).</p> <p>There are different types of porous membranes, made of different base polymers: e.g. cellulose, polyamides, polyols, polyphenols, polyvinylidene fluoride (PVDF),</p> | <p>Substance/ mixture</p> | <p>Link</p> |

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| | | <p>poly(tetrafluoroethylene) (PTFE), polypropylene (PP), and polyethylene (PE). There are also different fabrication processes.</p> <p>The pore structure, cross-section morphology, and thickness of the fabricated membrane is dependent on several factors, for instance the selection of polymer, polymer concentration in the casting solution, viscosity of the casting solution, solvent, non-solvent, additives (including pore formers), temperature, and fabrication process.</p> | | |
| Perforated paper coffee filter |  <p>Figure 51: Paper coffee filter</p> | <p>A perforated paper coffee filter is used for brewing coffee. It usually has a single use, after which it is disposed. The paper used has a specific morphology (microstructure) and is perforated with needles.</p> <p>Paper coffee filters are made from crepe paper (crinkled), where pulp with coarse long fibres is usually used. The paper is treated to increase surface area and to provide a crinkly crepe-like texture. It can be bleached or unbleached.</p> <p>Paper coffee filters are available in different shapes, to fit on different coffee making devices or set-ups, thicknesses, and pore sizes.</p> | <p>Article*</p> <p><i>*Note: This conclusion is achieved if the main function is <u>sieving</u> and not filtration. For more information, consult the detailed assessment.</i></p> | Link |
| Metal soap made of stainless steel |  <p>Figure 52: Metal soap made of stainless steel</p> | <p>Stainless steel soap is an object made of stainless steel resembling a soap bar or in a convenient hand-held shape. Its assumed purpose is to remove or reduce strong odours.</p> | Mixture (alloy) | Link |

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| <p>Cavity sealing system</p> |  <p>Figure 53: Cavity sealing system</p> | <p>Expanded material incorporated in openings, cracks and joints to seal e.g. in a building or in a car body, often applied with an extruder.</p> <p>The sealing systems are used to prevent noise and/or water and moisture from entering into a closed space.</p> | <p>Mixture</p> | <p>Link</p> |
| <p>Fire protection putty</p> |  <p>Figure 54: Fire protection putty</p> | <p>A fire protection putty is a highly viscous and flexible material with high plasticity, i.e., it can undergo continuous deformation and be reworked indefinitely.</p> <p>The putties are used for sealing in buildings walls and floors, as well as around pipes and cables.</p> <p>The material is mouldable to the size and shape of the opening, but does not have a special shape, surface or design in itself.</p> <p>The putty intumescent material reacts and swells in the presence of intense heat or fire and therefore closing openings and joints.</p> | <p>Mixture</p> | <p>Link</p> |
| <p>Mattress pads</p> |  <p>Figure 55: mattress</p> | <p>A foam mattress usually consists of a support pad, to bear the weight of a reclining human body, enclosed by a fabric (cover). It is used as a bed, or on a bed frame as part of a bed.</p> <p>The foam support pad can be made of latex, 'memory' or high-density polymeric foams, namely from natural and synthetic latexes, polyurethanes, polyesters, polyethers or mixtures of them.</p> <p>The foam support pad can be made of primary raw materials, secondary (recycled) materials or a mixture of both.</p> | <p>Article</p> | <p>Link</p> |

3. Table of detailed assessment of agreed borderline cases

Table 2: Detailed assessment of agreed borderline cases

| Object | Step 1: Identify the function of the object (Function: the purpose for which an object is to be used) | Step 2: Are shape/surface/design more relevant <u>for the function</u> of the object than the chemical composition? Yes: considered an article No: considered a substance/mixture <u>or</u> a combination of a substance/mixture and article(s) | Step 3 Object contains substance / mixture than can be separated from the object ? Yes: → Step 4 No: → Step 6 | Step 4 Q4a-c Mostly yes: substance/mixture <u>and</u> article Mostly no: → Step 5 | Step 5 Q5a-c Mostly yes: article Mostly no: substance/mixture <u>and</u> article | Step 6 Q6a-d Mostly yes: article Mostly no: substance/mixture | Conclusion |
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| Drill bit Note: Based on this assessment, the same conclusion is reached for other similar objects such as: a. Chisel and scraper blades b. Saw blade c. Rasp blade | The function is: Cutting and removing material (to make a hole) | Yes. The surface and the shape are crucial, e.g. cutting edge and spiral indentation. They are more important for the function (cutting and removing material) than the chemical composition. The chemistry of the material (the drill bit is made of) is important to provide the necessary performance and durability properties, such as hardness and wear resistance during use. However, it does not determine its function because the properties of the material are related to performance, durability and quality of the result. They do not determine the result in itself. | n.a. | n.a. | n.a. | n.a. | Article |

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| d. Knife blade e. Retractable blade | | | | | | | |
| Water-soluble plastic foil bag (to enclose a content) | <p>The function is: Containment and delivery (during use) of the content (e.g. detergent)</p> <p>The containment is done by enclosing, holding, preventing releases of the content, while protecting that content (e.g. detergent) and preventing its direct contact with the skin. It also facilitates handling and transportation of the content. It delivers the content during use by dissolving itself in water.</p> | <p>Yes. The shape, surface and design are more important for the function than the chemical composition as explained generically in subchapter 2.5 of the <i>'Guidance on requirements for substances in articles'</i>.</p> <p>The water-soluble plastic foil bag, which works as packaging for the content, is considered an article under REACH in its own right (see <i>Example 18: Polymer processing</i> in Appendix 4 of the <i>'Guidance on requirements for substances in articles'</i>).</p> <p>Its solubilisation into water allows the delivery of the content and determines its end of service life.</p> | n.a. | n.a. | n.a. | n.a. | Article |
| Water soluble foil bag with content (e.g. water-soluble tablet) | <p>The functions of the object as a whole (e.g. water-soluble tablets) are: Deliver or release the content.</p> | | n.a | n.a | n.a. | n.a. | Combination of an article (the bag) and a substance/ mixture (the content) |
| Reusable cold or warm pack filled with same phase and phase-transition content | <p>Cold packs' functions are absorbing heat from the surrounding environment or surface and enclose the cooling substance or mixture ('closed'</p> | <p>The most important physicochemical properties for the function are:</p> <ul style="list-style-type: none"> - specific heat capacity - specific latent heat (when there is a phase transition) or enthalpy of fusion | | | | | The cold or warm packs are considered a combination of a substance/mixture and a container or bag (article) to enclose and facilitating handling of |

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| | <p>container), whilst Warm pack's functions are releasing heat to the surrounding environment or surface and enclosing the warming substance or mixture ('closed' container)</p> <p>They are used for example in pain management, keep low temperatures in portable coolers and insulated shipping containers.</p> | <ul style="list-style-type: none"> - thermal conductivity between the pack and its surroundings <p>The chemical composition in question is the cooling medium or the warming medium (content).</p> <p>The high heat capacity and specific latent heat (or enthalpy of fusion) of the content – cooling/warming fluid or solid – are determinant for the function of reusable cold or warm packs.</p> <p>The enclosing container or bag needs to be made with a material which has good thermal conductivity: most polymers possess low thermal conductivity; however highly thermally conductive polymer composites have recently been developed to improve the thermal conductivity.</p> <p>The high heat capacity and specific latent heat (or enthalpy of fusion) of the content are physicochemical properties which are not related with the shape, surface, or design, but with the chemical composition of the content.</p> | | | | | the pack. |
| Single-use ("instant") cold pack | <p>The main functions are absorbing heat from the surrounding environment or surface and enclosing the cooling content</p> <p>The main use is pain management</p> | <p>The most important physicochemical properties for the function of the cooling content are:</p> <ul style="list-style-type: none"> - The enthalpy of solution (high, positive => endothermic reaction): - The lattice energy of a salt; enthalpy of solvent intermolecular forces; enthalpy of hydration (or mixing) - The thermal conductivity between the pack and its surroundings <p>The enclosing container or bag needs to be made with a material which has good thermal conductivity: most polymers possess low thermal conductivity; however highly thermally conductive polymer composites have recently been</p> | | | | | <p>The single-use ("instant") cold pack is considered a combination of substances or mixtures and bags (articles working as containers) to enclose the contents and facilitating handling of the pack: substance/mixture in the inside bag and substance/mixture in the external bag</p> |

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| | | <p>developed to improve the thermal conductivity.</p> <p>It is concluded that the chemical reaction and its enthalpy of solution are key for the function, not the shape surface or design of the cold pack</p> | | | | | |
| Heat patch or pack | <p>The functions of heat patches are releasing heat to the surrounding environment or surface and enclosing the warming content.</p> <p>The uses may be pain management, heat mats and hand warmers.</p> | <p>The most important (physico)chemical properties for the function are:</p> <ul style="list-style-type: none"> - negative enthalpy of reaction - thermal conductivity between the pack and its surroundings <p>The heat is released through an exothermic chemical reaction: e.g. oxidation of iron</p> <p>The enclosing air-permeable bag needs to be made with a material which has good thermal conductivity.</p> <p>The oxidation chemical reaction and its enthalpy of reaction are key for the function of the heat patch, not the shape surface or design of the cold pack</p> | | | | | <p>The single-use heat pad is considered a combination of a mixture and a bag (article working as container) to enclose the content and facilitating handling of the pack.</p> |
| Wax of an electronic candle (flameless) | <p>The functions of the wax hull are:</p> <ul style="list-style-type: none"> - Decoration; - Lamp holder; - Housing for electric components - Accessory – release of a fragrance (scenting) | <p>Yes. The shape and design of the wax hull are more important for the functions than the chemical composition of the wax mixture.</p> <p>In those cases where there is a scenting function, such function is an accessory function as defined in subchapter 4.1 of the 'Guidance on requirements for substances in articles'. The release of the fragrance substance or substances from the wax hull, which does not melt, is boosted by the heat released by the lamp. The release of a substance or substances is intended, because a fragrance is infused into the wax the hull is made of, and occurs under normal or reasonably foreseeable conditions of use as explained in the above-mentioned subchapter of the 'Guidance on requirements for substances in articles'.</p> | n.a. | n.a. | n.a. | n.a. | <p>Article with intended release of a substance or substances according to REACH Article 7(1).</p> |

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| | | Therefore, the wax hull of an electronic candle as described in this example is considered an article with intended release of a substance or substances (fragrance) according to REACH Article 7(1). | | | | | |
| Electronic wax “melter” (flameless) Note: Based on this assessment, the same conclusion is reached for other similar objects such as: a. Electric room freshener (diffuser) b. Electric insecticide diffuser] | The functions are scenting and decoration . | <p>The wax and its container or base are somewhat relevant for the decoration function, but it is key for the scenting function, i.e. the scenting function is the most important concerning the wax (chemical composition of interest).</p> <p>Scenting and decoration are both main functions. However, the scenting function is directly related with the wax composition – the chemical composition of interest, which is consumed upon use, preventing the scenting function. The decoration function is directly related with other components of the “melter”.</p> <p>Therefore, the wax holder acts as a container for the wax for release or controlled delivery of the fragrance into the air.</p> <p>Therefore, the wax holder in an electronic wax “melter” (flameless) for scenting (air freshener), is regarded as a combination of an article (container) and a mixture (wax with fragrance).</p> | n.a. | n.a. | n.a. | n.a. | Combination of an article (container) and a mixture (wax) |
| Air freshener for cars Note: Based on this assessment, the same conclusion is reached for other similar objects such as | The main function is the release of the fragrance, not the decorative function, which is accessory. An indication is that typically, after all the fragrance is released, the object is thrown away | <p>When looking at objects where the function seems to be the release of a substance/mixture, reference should be made to chapter 4 of the guidance on <i>requirements for substances in articles</i> (step 2 of the workflow in subchapter 2.3)</p> <p>Is the release of the substance an accessory function? No. The release of the fragrance is the</p> | n.a. | n.a. | n.a. | n.a. | Combination of an article (functioning as a carrier) and a substance/mixture (fragrance) |

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| refillable air fresheners for cars | away and replaced. The article works mostly as a carrier for the controlled release of the substance/mixture. | main function, not an accessory function. | | | | | |
| Coated electronic wax candle | The main function is decoration. | Yes. The wax is shaped in the form of the candle and the coating is completely incorporated in the shaped article (see 'Wax of an electronic candle'). It is a coated article (see scenarios III-A) and III-B) in table 5 of the 'Guidance on requirements for substances in articles'). | na | Na | na | na | Article |
| Coated conventional candle | The candle is lit to sustain a flame. The wick does not sustain the flame, it carries the molten wax to the centre of the flame, the burning of the wick is a secondary effect. | No. A conventional wax candle is a combination of an article and a substance/mixture. Therefore, a coated wax candle is a combination of an article and a mixture. In this case, the article is the wick. (The coating and the wax are either: - 2 different mixtures, - 2 substances, or - one substance and one mixture). | n.a | n.a. | n.a. | n.a | Combination of an article (wick) and a mixture (wax and coating) |
| Lubricants in engines and grease/oil on vehicle component/ lubricant on the steel cable | The lubricant function when used in engines, on vehicle components or steel cables, is to protect the article and prevent corrosion. The articles incorporating the lubricant keep their function. | It seems difficult to unambiguously reach a conclusion | Yes, in principle | a) no (its lubricating function is only achieved on the article or complex object); b) no; c) no. | a) yes (but may break or fail in a short time span); b) yes; c) yes. | | Integral part of the article |
| Permanent magnets | The function is: attract or repel other magnetic objects | No. Permanent magnets are used due to their magnetic properties, e. g. in cupboards to keep a door closed. They attract or repel magnetic objects through a magnetic force. According to the 'Guidance on requirement for substances in articles' Chapter 2.2: the magnetic properties of the permanent | n.a | n.a | n.a | n.a | Substance/ mixture |

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| | | <p>magnet are strongly related to its chemical composition and determine its function. Therefore, a permanent magnet is regarded as a substance or mixture.</p> <p>(See Q&A 1292 on ECHA's website)</p> | | | | | |
| Plastic or rubber granules (as infill material for sports pitches and playgrounds) | <p>The function is: A raw material or ingredient (filler) [to make (synthetic) pitches and playgrounds].</p> | <p>No. Granulates are solid particles produced in varied sizes, i.e. they do not have special shapes or surfaces. They can be made from rubber or other vulcanised or polymeric material of recycled or virgin origin or obtained from a natural source.</p> <p>For its function, the chemical composition of the granulate is more important for the function than the shape/surface/design. As an infill material in pitches and playgrounds, it cushions the ground (shock absorption and traction) which are directly related to their softness, a physical property directly related with the chemical composition of the granules.</p> <p>Therefore, the plastic or rubber granules are regarded as a substance or mixture.</p> | n.a | n.a | n.a | n.a | Substance/ mixture |
| Leca nuts | <p>The function depends on the type of use: e.g. - Ingredient in a mixture - Filler - Insulator - Adsorbent - Substratum</p> | <p>No. The relevant characteristics for the identified functions are the following:</p> <ul style="list-style-type: none"> - (Light)weight - Size - Sphericity, roundness, and smoothness - Density - Porous sizes – porous surface area - Porosity - Water absorption rate - Shear resistance - Thermal conductivity coefficient - Thermal diffusivity - Sound absorption - Wettability (in particular for aqueous medium) - Chemical composition - Chemical nature of the internal surface of the porous | n.a | n.a | n.a | n.a | Substance/ mixture |

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| | | <p>Most of these properties are directly related with the microstructure (porous sizes and porosity) and the physical and chemical characteristics of the material they are made of, and to a much lower extent with size and surface – the outermost layer - smoothness. Therefore, the shape, surface or design are not determinant for the identified functions of the LECA nuts.</p> <p>It is important to stress that the concept of shape refers to the three-dimensional form of an object outlined by the surface. The concepts of size and shape only overlap for perfect regular three-dimensional geometrical shapes, where the variation in each geometrical variable (e.g. length, width, depth, radius, semi-axes) among the units of an ensemble is very small. The LECA nuts within an ensemble show significant variations in size, as well as irregular shapes and surfaces.</p> <p>Following the workflow in section 2.3 of the '<i>Guidance on requirements for substances in articles</i>', the Step 2 question can be answered with 'no' (based on sections 2.1 and 2.2), i.e., the relevant characteristics of a LECA nut for its function are more related with the chemical composition than with the shape, surface or design and therefore is regarded as substance or mixture under REACH.</p> | | | | | |
| Low carbon steel shot | The function of low carbon steel shot is to be an abrasive – i.e., to smoothen/polish a surface | <p>No special shape is given during production. The chemical composition is key for the function.</p> <p>Low carbon and high manganese content result in:</p> <ul style="list-style-type: none"> longer lasting of the grit (durability): less machine wear (longer life of wear parts): brighter shot-blasted surfaces. | n.a. | n.a. | n.a. | n.a. | Substance/mixture |

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| | | <p>The carbon content is relevant. High carbon content provides:</p> <ul style="list-style-type: none"> greater shot blasting efficiency, therefore, abrasive consumption per shot blasted parts is lower; reduced costs, including energy, labour, spare parts, etc., due to higher productivity. a cleaner surface, not a glossier one; gloss is not a cleaning standard. <p>During shot blasting operations, low carbon steel shot is peeled down into thin layers similar to the layers of onions for up to 80 percent of their life due to wear and are only broken into small pieces due to fatigue of the material. However, the release of material is not essential, or even undesirable, for use.</p> <p>It is similar to the blasting grit example in the Guidance on requirements for substances in articles.</p> <p>That Guidance states the following: "Manufactured solid materials are by definition obtained in specific shapes and surfaces (e.g. granules, crystals, flakes, powders, etc.). These shapes and surfaces may be inherent to the physical properties of the manufactured materials. They may also be solely determined by the chemical starting materials used and the manufacturing process conditions applied. In both these cases, the manufactured materials are most likely to be substances (as such or in mixtures), even though the shapes and surfaces may also be deliberately controlled for the main purpose of optimising the further processing and/or the handling of the solid materials."</p> <p>From the above, low carbon steel shot should be regarded as a substance/mixture.</p> | | | | | |
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| Glitter | To create a sparkling and shimmering effects | The shape of the particles is important for the sparkling and shimmering effects, as it has an influence on the reflection, scattering and possibly other effects of light. However, the chemical composition is more important for the function than shape, surface or design, because all those light effects can only be realised through certain chemical compositions due to the refractive indices of the chemical components. The refractive index is a physical property of an optical medium. | n.a | n.a | n.a | n.a | Substance/mixture |
| Silver/aluminium oxide catalyst | Catalyst | <p>To be an article, the shape, surface, or design of the object "must be deliberately determined and given during a production step. Manufactured solid materials are by definition obtained in specific shapes and surfaces (e.g. granules, crystals, flakes, powders, etc.).</p> <p>These shapes and surfaces may be inherent to the physical properties of the manufactured materials.</p> <p>They may also be solely determined by the chemical starting materials used and the manufacturing process conditions applied.</p> <p>In both these cases, the manufactured materials are most likely to be substances (as such or in mixtures), even though the shapes and surfaces may also be deliberately controlled for the main purpose of optimising the further processing and/or the handling of the solid materials" (section 2.2. of the SiA Guidance).</p> <p>Both the aluminium oxide and silver particles result from a chemical manufacturing process, where no special shape, surface or design is given to them: e.g., there are significant variabilities in their dimensions (dispersity in size and shape) and surface. Some heterogeneity can also be expected for the surface</p> | n.a | n.a | n.a | n.a | Substance/mixture |

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| | | <p>density and distribution of silver particles on and within the porous Al₂O₃ substrate. Therefore, the shape, surface, or design of the aluminium oxide and silver particles is not deliberately determined and given during manufacture and cannot be regarded as articles under REACH.</p> <p>The most important properties for the silver/aluminium oxide (Ag/Al₂O₃) catalyst pellet or particle are its activity, selectivity, stability, and low corrosiveness. These are to a great degree chemical-dependent properties. The activity and selectivity are dependent of the chemical nature of the active sites (chemical affinity) of the silver particles, but also of other intrinsic characteristics such as:</p> <ul style="list-style-type: none"> - Surface density and distribution of the silver particles on the porous substrate (at both external surface of the particle and internal porous surfaces); - Size of the silver and Al₂O₃ substrate particles; - Hydrophilicity/hydrophobicity; - Surface to volume ratio of the porous Al₂O₃ substrate; - Specific surface area of the porous Al₂O₃ substrate; - Morphological characteristics of the porous Al₂O₃ substrate, e.g. pore size distribution and pore shape, porosity, ratio between accessible and inaccessible pores. <p>Other process conditions also contribute to the activity and selectivity of the silver catalyst such as mass and heat transport during reaction, flow conditions in the reactor, temperature, pressure and potential use of promoters or inhibitors. The intrinsic properties of the silver catalyst particle listed above are not the shape or surface as defined in the subchapter 2.2 of the Guidance on requirements for substances in articles</p> | | | | | |
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| | | <p>(SiA Guidance), which are not to be confused with other chemical, physicochemical and physical characteristics that result from the chemistry of the material(s) the silver catalyst is made of (see subchapter 2.2 of the SiA Guidance)</p> <p>Furthermore, the catalytic function is a typical chemical technical function (processing aid or regulator) according to Table R.12-13 and Table R.12-15 of the <i>Guidance on Information Requirements and Chemical Safety Assessment - Chapter R.12: Use description</i>.</p> <p>During use in the reactor, the catalyst particle may undergo cleavage and/or fragmentation, losing its initial shape and surface and still is able of performing its function, which also indicates that these properties are not the most important ones for the function.</p> <p>Thus, the catalysis is mostly dependent on the intrinsic properties listed above, i.e. properties that result from the chemistry of the material(s) that the silver catalyst particle is made of and not of the shape and surface. The chemical composition determines the function of the particle as a catalyst.</p> <p>Conclusion: Both the aluminium oxide and silver particles are to be regarded as substance/mixture, as well as a silver/aluminium oxide (Ag/Al₂O₃) catalyst particle under REACH.</p> | | | | | |
| Inflator of an airbag system | <p>Main function(s) of the inflator: generation and release of gas(es)</p> <p>Chemical composition in</p> | <p>No. The main function of the pyrotechnic inflator (generate and release gases) is mostly dependant of a chemical reaction (non-detonative self-sustaining combustion/explosion). The output of the reaction is almost coincidental with the function of the inflator (generate gases</p> | n.a. | n.a. | n.a. | n.a. | Combination of articles and a mixture (pyrotechnic mixture) |

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| | question: pyrotechnic mixture (propellant) | <p>accompanied by a large increase in volume or pressure).</p> <p>The chemical composition of the pyrotechnic mixture (chemical composition of concern) is the most important element for the function of the inflator. Therefore, it should be considered as a combination of articles (container) and a mixture (pyrotechnic mixture).</p> | | | | | |
| 3D printing filament used as thermo-plastic raw material for 3D printers | The function is a raw material for 3D printing | <p>No. A 3D printing filament is a raw material for 3D printing. A filament is made from a melted thermoplastic polymer, often mixed with other additives.</p> <p>During 3D printing, the filament is heated above its glass transition temperature, losing its shape, and consumed during use, to construct the 3D object.</p> <p>From this, and notwithstanding the convenience for the specific shape of a 3D printing filament for handling and feeding the 3D printer, it is clear that the chemical composition of the wire is more important for its function than the shape, surface, or design.</p> <p>In conclusion, 3D printing filament is to be considered a substance or a mixture under REACH. The assessment of such filament is not covered by example 18 of the appendix 4 to the '<i>Guidance on requirements for substances in articles</i>'.</p> | n.a. | n.a. | n.a. | n.a. | Substance/ mixture |
| Soldering or welding metal wire | The function is to join or hold two or more articles or objects together. | <p>No. During application in joining two or more articles or objects together by welding or soldering, the welding or soldering metal wire as a whole is fused, losing its shape, and consumed during use.</p> <p>The chemical interaction and compatibility between the molten flux and the metal substrates is to be joined, as well as the (eventual) prevention of oxidation of the</p> | n.a. | n.a. | n.a. | n.a. | Mixture (alloy) |

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| | | <p>metals to be joined, during the joining process (welding or soldering) are the most important properties for the function of a welding or soldering wire.</p> <p>From the above, and notwithstanding the convenience for the specific shape of a welding or soldering wire for handling and applying a fusible welding or soldering material, it is clear that the chemical composition of the wire is more important for its function than the shape, surface, or design.</p> <p>Note that alloys are regarded as 'special mixtures' according to REACH Article 3(41) and recital 31, as explained in Q&A 31 on ECHA's website.</p> <p>In conclusion, a welding or soldering wire is to be considered a mixture (alloy) under REACH.</p> <p>The assessment of such wire is not covered by example 16 of the of the appendix 4 to the 'Guidance on requirements for substances in articles'.</p> | | | | | |
| Electric insulated wire | The function of the metal wire is to carry electric current. | <p>The electrical core metal (e.g. copper, aluminium) wire, before applying the melted insulation material, is in principle an article (e.g. see example 16 in Appendix 4 to the <i>Guidance on requirements for substances in articles</i> (SiA Guidance)).</p> <p>After applying the insulation melted material through e.g. extrusion and cooling, the insulation layer becomes part of the article. This production process is similar to a coating operation.</p> <p><u>Calculation of the concentration of a Candidate List substance:</u></p> <p>Providing that a Candidate List substance is only present in the solid insulation layer, scenarios III. A) and III. B) of Table 5 in</p> | n.a. | n.a. | n.a. | n.a. | Article with an insulating substance/mixture |

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| | | section 3.2.3.1 of the <i>Guidance on requirements for substances in articles</i> are applicable to the insulation wire for the purpose of calculating the concentration of that Candidate List substance in the electric insulated wire. | | | | | |
| Electrical cable with insulated wires | The function of the electrical cables is to carry electric currents. | <p>The cable is a complex object made of two or more insulated wires protected by an outer jacket.</p> <p><u>Calculation of the concentration of a Candidate List substance:</u></p> <p>For a Candidate List substance in the metallic wire the reference is the metallic wire without the insulation layer (scenario I of Table 5 in section 3.2.3.1 of the <i>Guidance on requirements for substances in articles</i> (SiA Guidance)).</p> <p>For a Candidate List substance in the insulation layer of the insulated wire, the reference is the total mass of the metallic wire and the insulation (see electric insulated wire example).</p> <p>For a Candidate List substance in any of the insulations of the cable with insulated wires, the reference is the total mass of the respective metallic wire, the respective insulation and $1/n$ of the mass of the cable jacket (for a cable consisting of n insulated wires, and $n \geq 2$).</p> <p>For a Candidate List substance in the cable jacket (outer protective layer), the mass reference is the mass of the whole cable.</p> | n.a. | n.a. | n.a. | n.a. | <p>Complex object made of two or more articles.</p> <p>The “once an article, always an article” principle applies to each inner insulated wire. If the insulated wires are placed on the market as individual articles, they are considered distinct insulated wires (articles).</p> |
| Glow stick | The function is to emit light | No. The function is achieved by mixing two mixtures that, when combined, undergo a chemiluminescent reaction emitting light. The function is thus determined to a greater degree by the chemical composition of the mixtures | n.a. | n.a. | n.a. | n.a. | Combination of articles (containers) and mixtures |

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| | | rather than the shape of the object. | | | | | |
| Match and safety match | The function is to create and sustain a flame | <p>The creation of a flame is dependent of the flammable and/or oxidising properties of the active ingredients on the match head (coated end). These are inherently physico-chemical properties derived from the chemistry of those ingredients.</p> <p>Without the substance/mixture deposited on the match head, the function of a (safety) match is never fulfilled – no flame is created. The wooden stick/stiff paper on its own will never create a flame, even if it is suitable to sustain a flame.</p> <p>Therefore, the chemical composition of the match head is unambiguously more important for creating a flame than the shape, surface, or design of the match. The match is regarded as a combination of a carrier (made of wood or other combustible material), and a flammable and/or oxidising substance/mixture under REACH.</p> | n.a. | n.a. | n.a. | n.a. | A match is a combination of a carrier (made of wood or other combustible material), and a flammable/oxidising substance/mixture |
| Sparkler | The function is to produce light effects, mainly as flying sparks, frequently accompanied by smoke and sound | <p>The creation of the light effects (mainly sparks), often accompanied by smoke and sound, is dependent on the chemical ingredients of the solid mixture deposited over the metal wire, while undergoing self-sustained exothermic chemical reactions. The production of those effects derives from the chemistry of those ingredients.</p> <p>Without the solid mixture deposited on the metallic wire, the function of a sparkler is never fulfilled – no light effects are produced. The metallic wire on its own will never create the light effects.</p> <p>Thus, the chemical composition is more important than the shape/surface/design</p> | n.a. | n.a. | n.a. | n.a. | A sparkler is regarded as a combination of a carrier (metallic wire) and a solid energetic mixture |

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| | | <p>of the sparkler to get the light effects.</p> <p>The sparkler is regarded as a combination of a carrier (metallic wire), and a solid energetic mixture under REACH.</p> | | | | | |
| <p>Pocket lighter</p> <p>Note: Based on this assessment, the same conclusion is reached for other similar objects such as:</p> <p>Camping gas stove</p> <p>Kitchen stove with gas burners</p> <p>Gas barbecue/grill]</p> | The function is to create and sustain a flame | <p>For a pocket lighter, the flammable (and often volatile) fluid, used as fuel, due to its chemical and physicochemical properties is key for creating and sustaining the flame.</p> <p>The flame is created when the flammable fluid is ignited and it is sustained while being fed by the same fluid, i.e. the flame is extinguished if the controlled delivery of the fluid is interrupted in any way. Without the fluid, the function of a lighter is never achieved – no flame is created and sustained.</p> <p>The whole “container”/ delivery device of a lighter is a complex object made of several articles (body, base, springs, etc.). Without the fuel fluid the lighter container cannot fulfil the main function of the lighter.</p> <p>A lighter is therefore regarded as a combination of articles (functioning as container and controlled delivery set-up) and a substance/mixture (the flammable fluid working as fuel for the flame).</p> <p>In this example, the chemical composition assessed was that of the flammable fluid (fuel). Other components (objects) of the lighter need to be assessed separately to decide whether they are articles or not under REACH (e.g. a spark wheel).</p> | n.a. | n.a. | n.a. | n.a. | Combination of articles (container and controlled delivery set-up) and a substance/mixture (fuel) |
| Heat source for tobacco products based on a chemical reaction | The functions of the carbon heat source are to undergo an exothermic reaction (combustion) and transfer heat. | No. The main function of the object is only achieved through an exothermic chemical reaction, which shows that the chemical composition is key for the function. Other characteristics relevant for the function are the surface area and the | Yes, mixture can be separated | 4a yes 4b no 4c yes | n.a. | n.a. | Combination of an article and a mixture |

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| | <p>The function of the foil is to create a barrier between the carbon heat source and the tobacco, preventing direct contact and the burning of the tobacco</p> | <p>porosity to allow the inflow of air, which are closely related with the chemical composition.</p> <p>The foil is given a special shape and is an article which, however, needs to have a high thermal conductivity.</p> <p>The chemical composition of the carbon heat source seems to be more important for the identified function. Therefore, it is considered a combination of an article (foil) and a mixture</p> <p>The mixture is fully consumed upon use and the object is discarded.</p> | | | | | |
| <p>Standard gold bar (or gold bullion or gold ingot)</p> | <p>The function is: to store value</p> | <p>No. The value stored by the gold bar is intrinsically linked to the chemical element gold (Au) i.e. the value of metallic gold stored in a gold ingot does not depend on its physical properties shape, surface, or design.</p> <p>To achieve its function (to store value), the gold bar is required to have a very high degree of metallic gold purity. Furthermore, it is also required to have the density, the colour and the inertness (very stable against wear (e.g. corrosion/oxidation) of metallic gold. These are all intrinsic properties related to metallic gold.</p> <p>In conclusion, even if the shape, surface, and design of a standard gold bar facilitates identification, handling, storage, and transportation, it is the chemical composition that determines to a greater degree its function: to store value.</p> <p>Therefore, a gold bar must be seen as a substance according to the REACH Article 3(1) definition.</p> <p>Please note that gold (Au) (EC 231-165-9,</p> | n.a. | n.a. | n.a. | n.a. | Substance |

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| | | CAS 7440-57-5) is registered under REACH. | | | | | |
| Perforated disk metal coffee filter (nonwoven) | <p>The function is: to retain coffee grounds - sieving</p> <p>Sieving means, in this case, a two-dimensional mechanical or physical size exclusion separation at a single screen layer (a sieve), e.g. perforated sheet or woven mesh.</p> | <p>Yes. The sieving function (retention of coffee grounds) is determined by the size of the holes (e.g. diameter) in the perforated screen layer or barrier. In this case, the size of the holes in the perforated metal disk which works as a coffee sieve. Any oversized solid particles contained in the "feed" (suspension of ground coffee in water), cannot pass through the perforated metal disk holes (screen), being retained above the disk (used coffee grounds), while the fluid (brewed coffee) passes through the holes.</p> <p>Therefore, the shape, surface and design are more important for the sieving function of the perforated disk metal coffee filter (nonwoven) than its chemical composition.</p> <p>The perforated disk metal coffee filter (non-woven) is an article under REACH.</p> | n.a. | n.a. | n.a. | n.a. | Article |
| Porous transversal (micro) filtration membrane | <p>The function is filtration and sorption.</p> <p>Filtration means, in this example, the mechanical or physical three-dimensional separation of solid matter from other matter through a multilayer lattice of an interposing medium.</p> <p>Filtration in this case differs from sieving (as defined in 'Perforated paper</p> | <p>No. In filtration, one or more components are separated from a fluid (feed), based primarily on size differences of solid particles. The main difference between filtration and sieving relies on the screening barrier used. In addition, often sorption also plays a role on the separation when a membrane is used, i.e. separation of components based on physical, chemical and physicochemical interactions. For instance, a membrane separates not only solid particles, but also hydrophobic substances from an aqueous feed. The fluid that passes through the membrane is called filtrate.</p> <p>The most important properties for the function of a porous transversal (micro)filtration membrane (separation of one or more components from a fluid</p> | n.a. | n.a. | n.a. | n.a. | Substance/ mixture |

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| | <p>coffee filter'), because the separation occurs through a three-dimensional multilayer lattice of an interposing medium (membrane), and not only at the upper surface (the outermost layer).</p> | <p>(feed)) are:</p> <ul style="list-style-type: none"> - porosity, pore size distribution and pore shape; - ratio between accessible and inaccessible pores; - hydrophilicity/hydrophobicity of the membrane; - tensile strength; - surface; and - thickness. <p>It is important to highlight that during the fabrication process of a membrane, no special surfaces are given to the membrane, since they result from the casting (demixing and/or precipitation), and the thickness may have some variabilities. Typically, the polymer is dissolved in a casting solution, which undergoes phase separation by induced demixing and/or precipitation during casting in a support. The casted membrane is dried and rolled in a master roll. The porous membrane roll is then further cut into different dimensions (shapes), usually disks of different diameters.</p> <p>The intrinsic properties of the material, the porosity and microstructure are more relevant for the function than the special shape (thickness) of the object given during production. The characteristics that are relevant to perform the function are mostly related to characteristics that result from the chemistry of the materials the filter (membrane) is made of or from the fabrication process used.</p> <p>Following the workflow in Section 2.3 of the '<i>Guidance on requirements for substances in articles</i>', the Step 2 question can be answered with 'no' (based on Section 2.2), i.e. the filter is thus a substance or mixture.</p> <p>Therefore, a porous transversal</p> | | | | | |
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| | | (micro)filtration membrane is regarded as a substance/mixture because the chemical composition is the determinant factor for the function. | | | | | |
| Perforated paper coffee filter | The main function is to retain coffee grounds. Therefore, both sieving (more important) and filtration are functions of a perforated coffee filter (see 'Porous transversal (micro) filtration membrane' and 'Perforated paper coffee filter'). An accessory function of perforated paper coffee filter is the separation of fatty molecules such as diterpenes from the brewed coffee. | <p>Yes. The retention of coffee grounds by the perforated paper coffee filter seems to be determined by the size of the holes (e.g. diameter) in the perforated paper, but also by the interstices between the coarse long paper fibres.</p> <p>The perforated paper coffee filter, taking into account the size of the coffee grounds, seems to work more as a sieve for the coffee grounds (see 'Perforated paper coffee filter') than as a filter (see 'Porous transversal (micro) filtration membrane'). The morphology of the paper fibres in the filter are more like a mesh than as a porous material.</p> <p>The retention of diterpenes by perforated paper coffee filter is an accessory function, and not the main function, which is sieving.</p> <p>Therefore, a perforated paper coffee filter is regarded as an article.</p> <p>*Note: If a manufacturer of a paper coffee filter considers that e.g. morphology, microstructure, hydrophilicity/hydrophobicity of the paper, tensile strength and other properties of the paper are more important for the function, then they should consider the coffee filter as a substance/mixture as described in 'Porous transversal (micro) filtration membrane' and not an article.</p> | n.a. | n.a. | n.a. | n.a. | Article* |
| Metal soap made of stainless steel | The function is to remove or reduce odours. | The mechanism of the stainless steel 'soap' is not fully understood. However, the removal of substances responsible for the odour seems to entail a chemical reaction at the surface of the soap. It has | n.a. | n.a. | n.a. | n.a. | Mixture (alloy) |

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| | | <p>been proposed that the formation and re-formation of a passive chromium oxide film on the alloy object may be relevant for removing or reducing odours.</p> <p>The chemical composition of the soap is more relevant for the identified function than the shape, surface or design, which are only relevant to be convenient hand-held, even if there is no release of a substance or mixture during use.</p> <p>Therefore, the object would be regarded as a mixture (alloy).</p> <p>The REACH Regulation refers to alloys as "special mixtures". Therefore, an alloy is to be treated in the same way as other mixtures under REACH.</p> | | | | | |
| Cavity sealing system | (Waterproofing, soundproofing, and/or fireproofing) <u>sealant</u> | <p>A cavity sealer is a mixture which expands during its application to seal cracks and openings, e.g., in a building or in a car body. The technical function of a cavity sealer is to work as a barrier or as a sealant (see definition in Table R.12-15 of the <i>Guidance on Information Requirements and Chemical Safety Assessment - Chapter R.12: Use description</i>).</p> <p>After application, the expandable sealing material does not present a special shape, surface or design. After application, the dry cavity sealer mixture is incorporated in the building, or in the objects of a vehicle, device or equipment.</p> <p>When used to seal cracks or openings in articles or between assembled articles, it is considered similar to the incorporation of an adhesive (mixture) in scenario II of Table 5 in section 3.2.3.1 of the '<i>Guidance on requirements for substances in articles</i>'.</p> | n.a | n.a | n.a | n.a | Mixture |

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| Fire protection putty | Moldable and intumescent (under intense heat) <u>sealant</u> (sealing an opening or joint in the event of intense heat or fire) | <p>A fire protection putty does not have a special shape, surface, or design, because it is a highly viscous and mouldable material which can undergo continuous deformation.</p> <p>In an event of fire (or intense heat), the putty undergoes swelling, moulds to the opening or joint and becomes hardened.</p> <p>From the above, a fire protection putty is regarded as a mixture under REACH.</p> <p>When hardened in an object other than a building or fixed structure, it is to be considered similar to the incorporation of an adhesive (mixture) in scenario II of Table 5 in section 3.2.3.1 of the '<i>Guidance on requirements for substances in articles</i>'.</p> | n.a | n.a | n.a | n.a | Mixture |
| Mattress pads | The function of a foam mattress pad is to work as a weight-bearing support for a reclining human body | <p>The horizontal dimensions of a mattress, usually, need to accommodate one (or two) human body(ies) in a supine position and the thickness needs to be suitable to bear its (or their) weight. In addition, even if not key for its function, when used on a bed frame, the mattress dimensions need to match the bed frame or base.</p> <p>Compressibility (firmness), pressure distribution, energy absorption, vibration dampening, thermal conductivity and temperature regulation, conforming to the body shape, network effect (restoration of structure) and breathability are all important properties of a mattress support pad to provide comfort and address ergonomic aspects (sophistication), but are not key for the identified function. Furthermore, all those properties are mostly related with the foam's internal structure and microstructure which is controlled by the chemical composition and production process of the foam and not with the shape, surface or design of the mattress support pad.</p> | n.a | n.a | n.a | n.a | Article |

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| | | <p>When considering Example 18 in Appendix 4 of the Guidance on requirements for substances in articles and comparing it to the production of a foam mattress support pad, it seems that the transition point in the polymer processing to produce an article is when a foam profile is obtained. This foam profile can then be further processed by cutting it to the relevant horizontal dimensions.</p> <p>A foam mattress support pad (either made of primary, secondary or a mixture of both) is considered an article under REACH, because its shape is more important for its function as a weight-bearing support for a reclining human body than its chemical composition.</p> | | | | | |
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4. Appendix: List of figure sources

| Figure | Source |
|---|---|
| Figure 1: Twist drill bit | https://pixabay.com/de/photos/bohrer-bohrmaschine-metall-1827131/ accessed on 30/09/2020, author: LeoNeoBoy |
| Figure 2: Chisel blade | https://www.vecteezy.com/photo/2545010-set-of-chisels-on-the-workbench , accessed on 30/09/2020, author: Yurii Romanov |
| Figure 3: Saw blade | https://pixabay.com/vectors/handsaw-tool-hand-saw-wood-work-159622/ , accessed on 16/11/2022, author: OpenClipart-Vectors / 27376 |
| Figure 4: Rasp blade | https://pixabay.com/photos/files-rasps-tools-set-iron-steel-4463773/ , accessed on 16/11/2022, author: papazachariasa / 454 images |
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| Figure 7: Water soluble film pouch (to enclose a content) | Own work, 2022 |
| Figure 8: Water soluble foil bag with content | https://picjumbo.com/putting-dishwashing-capsules-in-a-dishwasher/ accessed on 10/03/2023 author: Viktor Hanacek |
| Figure 9: Water soluble dishwashing tablets | https://www.istockphoto.com/fi/valokuva/pesuaine-kapseli-gm844466276-138359293?phrase=dishwasher%20capsules accessed on 6/03/2023 author: s-cphoto |
| Figure 10: Freezer ice packs | https://commons.wikimedia.org/wiki/File:Freezer_ice_packs.jpg , accessed on 25/10/2023, author Santeri Viinamäki |
| Figure 11: Reuseable cold pack | https://www.flickr.com/photos/knight725/5876444192/in/photostream/ , accessed on 25/10/2023, author Knight725 |
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| Figure 13: Ice pack with velcro wrap | https://www.flickr.com/photos/lizhenry/6838814929 , accessed on 25/10/2023, author: Liz Henry |
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| Figure 15: hand warmer | https://commons.wikimedia.org/wiki/File:Handwarmers.JPG , accessed on 02/11/2020, author: P. B. Mann, the image was modified to hide the depicted coin |
| Figure 16: Electronic candle | https://www.pexels.com/photo/christmas-decor-with-flaming-candle-at-home-6101988/ , accessed on 06/02/2023, author: Laura James |
| Figure 17: Electronic wax melter | own work, 2023 |
| Figure 18: Figure 18: Electric diffuser | https://pixabay.com/de/photos/aroma-duft-diffuser-diffusor-4076727/ , accessed on 6/02/2023, author asundermeier |
| Figure 19: Car air freshener | https://commons.wikimedia.org/wiki/File:Car_air_freshener.svg , accessed on 26/10/2023, author: j4p4n |
| Figure 20: air freshener for car | https://www.flickr.com/photos/misadventuresofmaja/14315817595/ , accessed on 17 April 2025, author: The MisAdventures of Maja |
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| Figure 22: Burning candle | https://pixabay.com/de/photos/kerze-flamme-flimmern-kerzenlicht-452966/ , accessed on 05/10/2020, author: Denise Chaney |
| Figure 23: Engine Oil | https://www.rawpixel.com/image/5962668/free-public-domain-cc0-photo , accessed on 26/10/2023 |
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| Figure 27: steel abrasive media | https://en.wikipedia.org/wiki/Steel_abrasive accessed on 17 April 2025, author: Swoolverton |
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| Figure 31: Car | https://pixabay.com/de/photos/crashtest-kollision-auffahrnfall- |

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| Figure 33: Chemical oxygen generator, cut-away view | https://en.m.wikipedia.org/wiki/File:Chemical_Oxygen_Generator,_Cut-away_View.gif , accessed on 30/04/2021, author: Pointbonita |
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| Figure 36: Insulated wire (insulation applied by extrusion of melted insulating material) | https://commons.wikimedia.org/wiki/File:Wire_transparent.jpg , accessed on 25/10/2023, author: Mx1991 |
| Figure 37: Insulated wires coated with a cable jacket that was incorporated by extrusion | https://en.wikipedia.org/wiki/Electrical_cable#/media/File:Leitungsende_Abisoliert_en.svg accessed on 24/10/2023, author: Marekich |
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| Figure 39: Glow stick | https://pixabay.com/de/photos/knicklichter-bunt-licht-leuchten-693818/ , accessed on 01/10/2020, author: Hans Braxmeier |
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| Figure 41: Sparkler | https://unsplash.com/photos/qwvv5QD0It0/ accessed on 05 April 2023, Author Nong V |
| Figure 42: Pocket lighter | https://unsplash.com/photos/rXgg90zA820It0/ accessed on 05 April 2023, Author Jozsef Hocza |
| Figure 43: camping gas stove | https://creazilla.com/media/clipart/3166058/burner accessed on 4 December 2024, Author: Clker-Free-Vector-Images |
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- Figure 47: Heat source for tobacco products based on a chemical reaction Own work, 2022
- Figure 48: Gold bar <https://unsplash.com/photos/Y9U4XZYbSQ4> accessed on 20/10/2022, author: Jingming Pan
- Figure 49: Perforated disk metal coffee filter <https://unsplash.com/photos/1SUtSGT3TD0>, accessed on 06/02/2023, author: cafeconcetto
- Figure 50: Funnel metal coffee filter Own work, 2022
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- Figure 55: Cavity sealing system https://commons.wikimedia.org/wiki/File:Expanded_foam_upon_heating.jpg accessed on 25/10/2023, author: Cjp24
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