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The most important news in sustainability, delivered weekly. gb&ds Network for the Built Environment gb&ds Top Architecture Projects To help you plan your year 5 science lesson on: Thermal insulators: do and review, download all teaching resources for free and adapt to suit your pupils' needs.The starter quiz will activate and check your pupils' prior knowledge, with versions available both with and without answers in PDF format.We use learning cycles to break down learning into key concepts or ideas linked to the learning outcome. Each learning cycle features explanations with checks for understanding and practice tasks with feedback. All of this is found in our slide decks, ready for you to download and edit. The practice tasks are also available as printable worksheets and some lessons have additional materials with extra material you might need for teaching the lesson.The assessment exit quiz will test your pupils' understanding of the key learning points.Our video is a tool for planning, showing how other teachers might teach the lesson, offering helpful tips, modelled explanations and inspiration for your own delivery in the classroom. Plus, you can set it as homework or revision for pupils and keep their learning on track by sharing an online pupil version of this lesson.Explore more key stage 2 science lessons from the Properties, changes and separating materials unit, dive into the full secondary science curriculum, or learn more about lesson planning.HARRY:There you go.FRANKIE:Check.HARRY:Anything else?FRANKIE:Just that tub of ice over there, please.HARRY:I mean, yeah, there's a tub, but it's. It's kind of all just. Water.FRANKIE:The ice melted.HARRY:YepFRANKIE:I knew I should have wrapped it to keep it frozen.HARRY:What? NoHARRY:Wrapping things up makes them warm up. Right.FRANKIE:We can figure this out.HARRY:I'm in, it's time for an investigation.HARRY:OK, well, first of all, we need to find some materials to wrap our icein, so let's find some material. OK. OK. I've got some kitchen foil.FRANKIE:Found some bubble wrap.HARRY:Kitchen foil bubble wrap. And anything else?FRANKIE:Will cloth work?HARRY:That will doHARRY:MethodHARRY:We're trying to find out which material is the most effectiveinsulator. For this experiment, We're going to use four trays, fourequal sized ice cubes, three to wrap in material and one to leaveunwrapped. Three equal sized sheets of material to wrap the icecubes in. We're using tinfoil, bubble wrap, and cloth. And scales tomeasure the weight of each ice cube after the experiment. Theheavier the ice cube, the less it's melted. Let's get started.FRANKIE:Okay, so we got our three materials cut off all of the same size.HARRY:Yes. And actually, if we had more of one material and than anyother, that would be an unfair test. Well, we also have to do is drawup at the table of results. OK. So on the left hand side of our tablewill be our change variable. And in this case, it is our materials onthe right hand side will be our measure variables. And what thatwill be is when we measure the weight of each ice cube after it'sunwrapped. Which one then do you think is going to do the trick?FRANKIE:To be honest, I don't know why, but the foil is calling my name.HARRY:Really?FRANKIE:Yeah, yeah, yeah.HARRY:Surely it's going to be the cloth.FRANKIE:Your reckon?HARRY:It's like. It's like when you wear a coat, right?FRANKIE:And there's something called insulation, OK? Insulation just keepsyou at the same temperature. It doesn't necessarily make you hotteror colder. It's just all the same.HARRY:There we go. And they all wrap the same and fairly evenly. So Iguess now all we have to do is wait and see.FRANKIE:All right, let's see then.HARRY:Well, straight away, look at this one, the unwrapped ice cube.FRANKIE:Look at this.HARRY:That tray is absolutely soaked in water.FRANKIE:River Thames right there.HARRY:So that looks like on the face of it, that looks like nothing much.OK. But, look at cloth, feel that it is soggy. It is soaked up andabsorbed all of the water.FRANKIE:Wow.HARRY:What about foil?FRANKIE:Oh, nothing.HARRY:Not too much. Again, tray. Bone dry. Finally, bubble wrap a little bitof water.FRANKIE:Okay. Yeah, I can see hiding itHARRY:But not a lot though.HARRY:And that's not absorbed it at all.FRANKIE:OK. You know, I think we should just weigh the ice cubes.HARRY:I think so. Go on then should we start with the unwrapped one turnit to zero grams.FRANKIE:So that 33.HARRY:Yes.HARRY:So that was unwrapped. So shall we do cloth next?FRANKIE:OKFRANKIE:I thought this was going to be heavier. 53.HARRY:53.FRANKIE:OK.HARRY:OK. 53 grams.FRANKIE:Perfect. So there you go.HARRY:Go next.FRANKIE:I'm feeling about this one.HARRY:OK.HARRY:This one feels There's not a lot of water in the tray.FRANKIE:Yeah, feels like a biggie.HARRY:Oh 50 oh 55 It's gone up last minute. 55. OK come on should I doBubble Wrap.FRANKIE:There you go.HARRY:Ok. Bubble wrap, 57 grams.FRANKIE:OK.HARRY:Right. So now we just have to figure out what will these resultsmean? We've been trying to find out which material is the mosteffective insulator. We learnt that bubble wrap was the best byobserving that the ice cube we wrapped in bubble wrap was heavierafter 10 minutes than the other three ice cubes we tested. Thismeans it had melted the least. Investigations like this are great forhelping us learn about the world around us. Remember, you need achange variable, a measure variable, and a way of controlling yourexperiment to make it a fair test.FRANKIE:So what are you waiting for?Its time for a picnic and presenters Harry and Frankie want to take some ice with them to keep their food cool.However, ice melts really easily. So, they investigate whether wrapping ice in a material stops if from melting and if so, which material works best?To do this, they set up a comparative test.In the test, the change variable was the type of material used to wrap the blocks; the measure variable was the weight of the ice.This short film is from the BBC Teach series Experiments in controlled environments.Back to topBefore WatchingAsk your learners which foods they like to take on a picnic or have in their packed lunches? How do they keep those foods cold? Why is it good to keep food cool?Imagine you are going to test some materials bubble wrap, fabric, foil and no material to see which one keeps an ice block frozen. Which one do you think would work best? Why?Materials that dont conduct heat well are called insulators. Ask the children how an insulator might help keep food fresh?After WatchingLook at the table of results again. What conclusions can you draw from this data? Why was bubble wrap the best material for keeping the ice from melting? Ask the children to rank the results from best to worst. How much larger was the ice block when wrapped in bubble wrap, compared to the ice block without any wrapping?The bubble wrap is a good insulator. Ask your children to explain how the bubble wrap was preventing the ice from melting too quickly. Ask your children to think about other places where they see insulation? Have they got a food or drink container with insulation? Which materials are used as insulators?Try out this investigation. Can you find any other materials that are good insulators?Key Scientific KnowledgeInsulation thermal insulation consists of materials that conduct heat poorly. Many good insulators are made of non-metallic materials filled with tiny air spaces. Insulation, reduces the movement of energy in either direction.Melting - heat melts a solid and turns it into a liquid.Developing Practical Enquiry SkillsComparative test enquiries - comparative test are an opportunity for children to make comparisons. In this case we are comparing materials. To set up a comparative test we change one variable, measure another variable and keep all the other variables the same.Variables these are factors that could be controlled or changed as part of an experiment. In a fair or comparative test there is one change variable (independent variable), one measure variable (dependent variable) - the variable being measured or observed. All other variables are controlled and kept the same.Constructing a table tables are an important tool for collecting and organising information. Tables are made of columns and rows. Usually, the change variable (independent variable) is recorded in the left-hand column. The right-hand column records the measurements or observations (dependent variable). Each column should be labelled, including the units of measurement as appropriate.Conclusion - To draw a conclusion is to make a judgement based on the evidence you have gathered. A conclusion includes a summary of whether any patterns were spotted in the data; plus, an explanation of the findings using appropriately scientific language.Ideas for further learningSome materials work better as insulators if they are used in combination with another material or if you use more than one layer. Ask your learners to investigate which combination of materials might work together to keep an ice block frozen for even longer.These short film clips support teachers with practical enquiry. They can be both used as a resource for learners to watch at home. Or as a stimulus to support learners to plan and conduct their own science investigations. They link to the UK Science curricula.MaterialsPupils group materials together, according to whether they are solids, liquids or gases.Pupils observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (C).Science enquiry / Working scientifically skillsPupils should plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.Pupils should take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.Pupils should record data using tables.Back to topBack to topLanguage:EnglishCymraegGaeilgeGidhlig **Unlimited Quizzes Await You! ** Hey there, quiz champ! You've already tackled today's free questions. Ready for more? Unlock UNLIMITED Quizzes and challenge yourself every day. But that's not all... As a Subscriber you can join our thrilling "Daily Streak" against other quizzers. Try to win a coveted spot on our Hall of Fame Page. Don't miss out! Join us now and keep the fun rolling. Subscribe & Play Maybe Later 60 mins | Suitable for stages: 3 - 4 A 60 minute lesson in which students will investigate which materials are the best thermal insulators. Login to view the lesson plan. We create premium quality, downloadable teaching resources for primary/elementary school teachers that make classrooms buzz!Piping Thermal Insulation is very important for saving energy costs and maintaining the process fluid temperature at the required level. In case, thermal Insulation is appropriately chosen and used so that it is Non-complaining, Maintenance-free, and Patient workhouse, It looks after the economy with tremendous savings in energy costs, the safety of personnel, and smoother process control.On the other hand, insufficient or poor piping insulation or deterioration of existing thermal insulation can be a cause of huge energy loss. So most of the time, thermal Insulation is defined as, A major tool in improving energy availability. The thermal insulation material is also important to achieve low thermal conductivity and low thermal inertia.The basic objective of thermal insulation is to retard the flow of heat:From a hot surface to a cold environment orFrom a warm environment to a cold surfaceInsulated PipesFig. 1A and Fig. 1B below show a typical example of heat losses from the piping surface if the pipe is not insulated.Fig. 1A: Example showing Heat Loss from Hot SurfacesFig. 1B: Energy loss from the pipe without thermal insulationThe heat loss values are normally corrected by the correction factor for certain applications.Piping thermal insulationReduces fuel consumption, and hence overall operational cost so day-to-day economic benefits.Reduces capacity requirements for heating/cooling systems (boiler, refrigeration unit, etc)Savings in Capital costsEven though the basic requirement for providing thermal insulation is Economic, still it is not the sole criterion. The process requirement controls the usage of thermal insulation.Reduces the temperature drop of fluid in a heated systemReduces temperature gain of fluid in the refrigerated system.Reduces boil-off rate in a volatile liquid storage systemAssist in maintaining thermal balance in the reaction systemIn the heated system, it lowers temp. of exposed surfaces-protects workmen from burn hazardProvides fire protection for plant, equipment & pipingReduces capacity requirements for heating/cooling systems (boiler, refrigeration unit, etc)The thermal insulation thickness for which the total cost (insulation material cost + energy cost) is minimum is termed as economic thickness. Refer to Fig. 2 below which shows the total cost for a typical plant. Similar curves are plotted to find out the economic thermal insulation thickness.Fig. 2: Determination of Economic ThicknessBy virtue, Insulation shall resist heat transfer by:RadiationConvectionConductionMass-type insulation: Based on interposing a mass of material with a built-in capacity to retard heat flowReflective Insulation: Based on providing a series of the reflective surface with the intervening space s evacuatedMicroporous Insulation: Based on a combination of Mass & Reflective technologies.Significant physical parameters of thermal insulating materials can be divided into:Thermal PropertiesChemical PropertiesCommercial FactorsThe basic thermal parameters that thermal insulation materials should possess are:Temperature resistanceThermal conductivityThermal diffusivity, andThermal shock resistanceMajor Chemical properties of insulating materials are:Compatibility with the metal surfaceCompatibility with environmental mediaDeterioration arising out of the chemical actionLife of insulation materialAlkalinity (pH) or acidityChemical Reactivity/passivityCoefficient of Expansion / ContractionCompressive Strength & Breaking LoadAbrasion ResistanceCombustibilityMost importantly, THERMAL CONDUCTIVITYThe thermal conductivity of a material provides the heat loss per unit area per unit insulation thickness per unit temperature difference. The unit of measurement is W-m2/mC or W-m/C. With an increase in temperature, the thermal conductivity of materials increases. That is why the thermal conductivity for thermal insulation materials is always specified at the mean temperature (mean of hot and cold face temperatures). Fig. 3A provides a curve showing the relation between thermal conductivity and density of the thermal insulation material.Fig. 3A: A curve showing the relation between Thermal Conductivity and DensityRefer to Fig. 3B below which provides some typical thermal conductivity values for hot and cold insulation materials.Fig. 3B: Thermal conductivity of hot and cold thermal insulation materialsMineral WoolCeramic FibreCalcium SilicateREAD What is Category M Fluid Service for Process Piping Design?Expanded Polystyrene Foam (EPS)Extruded Polystyrene Foam (XPS)Polyurethane Foam (PUF)Poly-isocyanurate Foam (PIR)Foam glassPhenolic FoamThermocolAmong the above-listed materials, Polyurethane and Polyisocyanurate have assumed the highest importance because these possess many superiorities as compared to others. Both of these materials can be used as Pre-formed shapes or installed in-situ-by Pouring or by spraying.The outer part of insulation is normally provided with:Weather barriers-claddingsWeather and Vapor retarder, Indoor coverings, and finishesAll of these have only one basic function which is to protect the insulation material from severe external exposure media.The insulation system should perform to the expected level, undiminished over its life.This needs full data on material behavior under all conditions of exposure.In particular, we need to know what would make a material lose its properties.Thermal calculations need a representative value of Thermal Conductivity for the designStandard materials like Rockwool and Calcium Silicate have well-established Design k values.Limiting Service Temperature of useIn pipe applications, weight becomes critical. Abrasion is also a major problem with some materials.The most basic piping model with thermal insulation is shown in Fig. 4. where r1 denotes the pipe outside radius and r2 shows the radius of the Pipe including insulation.Fig. 4: Typical Pipe Cross Section with InsulationIn the calculation of thermal insulation, the first step is to calculate the heat loss from the pipe.READ What Causes Stresses in A Piping and Pipeline System?Heat loss from a surface is expressed as H = h X A x (Th-Ta) Whereh = Heat transfer coefficient, W/m2-KH = Heat loss, WattsTa = Average ambient temperature, KTs = Desired/actual insulation surface temperature, CTh = Hot surface temperature (for hot fluid piping), C & Cold surface temperature for cold fluids piping)For horizontal pipes, the heat transfer coefficient can be calculated by:h = (A + 0.005 (Th Ta)) x 10 W/m2-KFor vertical pipes,h = (B + 0.009 (Th Ta)) x 10 W/m2-KHere A, and B are coefficients that can be obtained from the table in Fig. 5Tm = (Th + Ts)/2k = Thermal conductivity of insulation at a mean temperature of Tm, W/m-oCtk = Thickness of insulation, mmr1 = Actual outer radius of the pipe, mmr2 = (r1 + tk)Rs = Surface thermal resistance =1/h oC-m2/WRl = Thermal resistance of insulation =tk/k C-m2/WThe heat flow from the pipe surface and the ambient can be expressed as followsH = Heat flow, Watts= (Th-Ta)/(Rl+Ra)=(Ts-Ta)/RsFrom the above equation, and for a desired Ts, Rl can be calculated. From Rl and the known value of thermal conductivity k, the thickness of insulation can be calculated.Equivalent thickness of insulation for pipe, Etk = (r1+tk) X ln{(r1+tk)/r1}Some more resources for you:Piping insulation: Important Considerations for Piping EngineerCorrosion under insulation: A Presentationlink to GRE Design Envelope and Failure Envelopelink to Effect of Coating Factor on Buried Pipeline Stress Analysislink to Comprehensive Piping Stress Analysis (Caesar II) Online Course (35+ hours)link to Detailed Online Course on Pipe Stress Analysis (25 hours of Content) with Certificate + Free Trial Version of Pipe Stress Analysis Softwarelink to GRE Design Envelope and Failure Envelopelink to Effect of Coating Factor on Buried Pipeline Stress Analysislink to Process Optimization in Gas Processing Plants: Strategies for Maximizing Efficiency and Profitabilitylink to Minimum Distance Between Welds as per International Codes and Standardslink to Top Instrumentation Engineering Deliverables for the Oil and Gas Industry Projectslink to What is ASME B31.3 PRESSURE LEAK TEST?Materials that allow electricity to pass through them easily are called electrical conductors. Examples of these materials include many metals, such as iron, steel, copper, and aluminum.Electrical objects use metal parts to conduct electricity, such as the copper wires inside electrical leads, the metal pins in plugs, and the metal wire filaments in lightbulbs.In a simple electrical circuit, copper wire is used to carry electricity from the energy source (such as a battery) to an electrical component (such as a lamp, motor, or bell).Carbon is an electrical conductor, even though it is not a metal. Water also conducts electricity, which is why electrical objects should not be used near water. SHA embraces heating and cooling/climate control, lighting, intercom, CCTV and security, home theatre, outdoor entertainment, blind and curtain control, assistive devices (designed to help people living with disabilities perform everyday tasks more easily as well as independently) and more. Over 1km of these innovative light strips were installed to accentuate the homes architecture and create striking visual effects. Impressed with the outcome, Nisi promptly integrated vibrant linear lighting into its showroom. By showcasing the technology in a real-world setting, they were able to inspire other clients and demonstrate the limitless possibilities of smart lighting. As the seasons shift and the crisp air of autumn settles in, our homes... Design expert Neale Whitaker has revealed James Hardie Modern Homes Forecasts eight home design styles that will run riot throughout 2025 in Australia. Black kitchens have taken over as a practical and visually appealing option. The kitchen designed... Micro-cement concrete flooring is ideal for kitchen floors because its non-slip and an easy... Jack, part of the White Group of building and construction solutions, has launched the... Over 1km of these innovative light strips were installed to accentuate the homes architecture and create striking visual effects. Impressed with the outcome, Nisi promptly integrated vibrant linear lighting into its showroom. By showcasing the technology in a real-world setting, they were able to inspire other clients and demonstrate the limitless possibilities of smart lighting. Ever wondered about what insulation actually does or what its made of or how it works? Find out everything you need to know with our introduction to insulation.Glasswool and rock wool batts are two of the most commonly used types of insulation in Australia.Insulation is material designed to prevent heat or sound from being transmitted from one area to another. Its normally used to keep heat and/or sound in or out of your home, or to confine it to certain parts of your house. Insulation can work in a number of different ways, but it most commonly incorporates materials that consist of millions of tiny pockets of air. Still air is an extremely good insulator, and trapped pockets of air are what give most types of insulation their high thermal resistance. Thermal insulation to control heatThis is the sort of insulation people normally think of first when they hear the word insulation. Thermal insulation is usually found in walls and ceilings, especially the outside walls of a home where heat is most likely to be gained or lost. The idea behind thermal insulation is very simple; to keep one side of the insulation warmer than the other. If you live in an area where the weather varies through the seasons, your insulation will need to be coupled with the correct passive design principles. If its always hot or cold where you live, then your insulation will be incorporated into the design with that in mind.The effectiveness of thermal insulation is measured by whats known as R values. The higher the R value, the better the thermal insulation it provides. There are two ways R-Values are specified, this can be the R-Value of the insulation material itself knownas the Rm, or the Total R value of the construction including all other layers of materials which may be concrete, bricks plasterboard etc. Total R Value is known as the RT. Reflective membranes when incorporated into a building system that has a still air space (not less than 20mm) will add to the RT of the construction but the reflective material itself does NOT have an Rm. Acoustic Insulation to control soundIn addition to controlling heat, insulation can also be used to control sound and to some extent every type if insulation will help to control both. Acoustic insulation is normally found in walls, ceilings and floors, but specialised soundproofing is usually reserved for special applications (like home theatres, for example).Likewise, if you live in an area where external noise from things like busy roads, airports, train lines or industrial machinery is an intrusion, you may also want to look at specialised ways to keep that sound outside. Acoustic insulation measures, particulary for windows, ceilings and walls, can make a big difference to your sanity. Can insulation do both?While thermal insulation can dampen sound transmission to some extent (and vice versa), most insulation types will strongly lean to one side or the other. When people ask this question, theyre normally asking whether thermal insulation will be sufficient as a sound insulator in a home. The answer is that it really depends on things like the volume and pitch of the noise that needs to be controlled, and how your house is constructed. In most homes that are only exposed to general low-level noise, thermal insulation will do the job well enough that you shouldnt need any additional acoustic insulation. Acoustic insulation can be very useful in the internal walls of your home to stop noise transmission between bedrooms and living spaces. What kinds of insulation are available?Probably the first type of insulation people think of is some sort of batt, usually glasswool or rockwool; batts are light, fluffy-looking panels of material that sit inside the frame of your home typically either in wall spaces or in your ceiling. Batts are made of fibrous materials, and work by trapping tiny pockets of air within fibres.Other common types of insulation include blow-in cellulose (which is easier to install if the house has already been constructed), polyurethane foam, polyester matting and reflective foil. Each type works differently to trap or repel heat, and offers different advantages and disadvantages.Dedicated acoustic insulation can require higher density fibrous insulation or other dense materials, and is often made of polymer-based materials like rubber or glue. In residential applications though, a systems combination of the density of the internal wall structure with the installed bulkinsulation will provide significant acoustic benefits. MUSIC PLAYINGHi, everyone, I'm Mwaksy. I'm Greg. Hey.Hey, Greg, so, question.You know how there are electric circuits all around us? Yeah?How is it that we don't get an electric shockwhen we touch the TV or turn on a lamp?That's a really good question.So if electricity did pass through a material then through our bodies,we would get an electric shock.But there are some materialsthat don't let electricity pass through them.The materials that do let electricity pass through themare called conductors.The ones that don't let electricity through are called insulators,and they're the ones that are really importantfor keeping us safe from electric shockswhen we use electric circuits.OK! I think I've got it, but I'm going to need youto show me the science! All right, let's do it.I've set up a little circuit experiment here.There's a low-voltage battery,a bulb, and a gap.That bit's important.I've got two spoons. One is plastic, one is metal.I'm going to try each one in turn filling the gap,to see which one lets the electricity flow through.We'll be able to tell which one completes the circuit,cos the electricity will flow all the way roundand the bulb will light up. Yeah.So my question to you, Mwaksy, iswhich spoon is going to be the best insulatorand which spoon is going to be the best conductor?OK. Well, I believe the metal spoonwill let electricity flow through it,so I'm going to say this is going to be the best conductor.OK. Shall we give it a go? Go ahead!All right. Plastic spoon first, then. OK.Nothing. OK, all right,let's swap it for the metal spoon.Go on, go on, go on, go on.Yeah! Oh, my God, that's working! Brilliant.So I was right! Yeah. So the metal spoonallows electricity to flow through it more easilycompared to the plastic spoon. Yeah.Making it the better conductor, yeah. I am a genius!So the reason I don't get an electric shock when I touch my TVis because I'm touching plastic, which we know is a great insulator.Yeah, you've got it. Metal is one of the best conductors,which is why we use it for the wires in our circuits,for our power cables,and lots of the electronic equipment inside our TVs and phones.But on the outside of TVs, phones, and in fact most electrical cables,you'll likely find an insulator like plastic or rubberbecause it won't let any electricity through.So you're right - that is why your TV is safe to touch.I should say, though, that unfortunatelyyour bodies are very good conductors,and that's why it is so important to be careful with electricity.We should never touch the conductor in a circuitwithout proper protection,and we should always be very careful around plug sockets.So to work with electricity and use it safely,we need to understand which materials are good insulatorsand conductors, right? Yeah. That bit is so important.Ooh. So do we have time for one more demo? Go on, then.Right then, Mwaksy, you know howI love to experiment with different materials?I thought we'd try something a little bit different -we'd make a circuit using dough.Yum! So two different types of dough here -one of them is a good conductor,one of them is a good insulator.I'm not going to tell you which one's which. OK.But we're going to discover it by building a circuit. Oh, fun, OK!This sounds good. Which one should we start with? Er, this one. OK.Cool. All right, so,let's connect the low-voltage battery into it like this. Yeah.Now if you put the LED, the bulb, across the gapDum-de-dumNo! Nothing.OK, all right. Let's move it to the next one, then.Greg! It lit up!That means there's something in this dough which makes it conductive.What is it? So I made this onewith salt, which helps electricity flow through it.This one, instead of the salt, it's got sugar,which doesn't help the electricity flow through it. OK!Well, now we know all about insulators and conductors,how they keep us safe and how they keep electricity flowing,so I feel like now's a good time to ask them a question.OK. Your question is this.If you were to design a new material,would it be a conductor or an insulator,and what would you make out of it? Ooh. The possibilities are endless.We'll see you soon! Bye! See you!To help you plan your year 5 science lesson on: Thermal insulators: plan, download all teaching resources for free and adapt to suit your pupils' needs.The starter quiz will activate and check your pupils' prior knowledge, with versions available both with and without answers in PDF format.We use learning cycles to break down learning into key concepts or ideas linked to the learning outcome. Each learning cycle features explanations with checks for understanding and practice tasks with feedback. All of this is found in our slide decks, ready for you to download and edit. The practice tasks are also available as printable worksheets and some lessons have additional materials with extra material you might need for teaching the lesson.The assessment exit quiz will test your pupils' understanding of the key learning points.Our video is a tool for planning, showing how other teachers might teach the lesson, offering helpful tips, modelled explanations and inspiration for your own delivery in the classroom. Plus, you can set it as homework or revision for pupils and keep their learning on track by sharing an online pupil version of this lesson.Explore more key stage 2 science lessons from the Properties, changes and separating materials unit, dive into the full secondary science curriculum, or learn more about lesson planning.,the free encyclopedia that anyone can edit.117,937 active editors 7,001,078 articles in EnglishThe English-language Wikipedia thanks its contributors for creating more than seven million articles! Learn how you can take part in the encyclopedia's continued improvement.GL Mk.II transmitter vanRadar, Gun Laying, MarkI, or GL Mk.I for short, was an early World WarII radar system developed by the British Army to provide information for anti-aircraft artillery. There were two upgrades, GL/EF (elevation finder) and GL Mk.II (pictured), both improving the ability to determine a target's bearing and elevation. GL refers to the radar's ability to direct the guns onto a target, known as gun laying. The first GL sets were developed in 1936 using separate transmitters and receivers mounted on gun carriages. Several were captured in 1940, leading the Germans to believe falsely that British radar was much less advanced than theirs. The GL/EF attachment provided bearing and elevation measurements accurate to about a degree: this caused the number of rounds needed to destroy an aircraft to fall to 4,100, a tenfold improvement over early-war results. The Mk.II, which was able to directly guide the guns, lowered the rounds-per-kill to 2,750. About 410 Mk.Is and 1,679 Mk.IIs were produced. (Fullarticle...)Recently featured: Andrea NavageroNosy KombaMcDonnell Douglas Phantom in UK serviceArchiveBy emailMore featured articlesAboutLieke Klaver ahead in the women's 400 metres final... that a 400-metre race in 2025 (pictured) was won by Lieke Klaver, who pretended that an absent competitor was running in front of her?... that the land snail Drymaeus poecilus is notable for the striking variety of colors and patterns on its shell?... that a forensic investigation of Signalgate has determined how a journalist was included in a group chat about Operation Rough Rider?... that two of the players involved in the 2005 Vietnamese football match-fixing scandal did not accept payment because they felt ashamed?... that a rebellion against a peace treaty with the Yuan dynasty operated out of the Historic Site of Anti-Mongolian Struggle on Jeju Island?... that Nathan Frink fled the United States with enslaved children to settle in Canada, where he was elected as a Member of the Legislative Assembly and caught in a smuggling conspiracy?... that Seattle's women's ice hockey team has an expected rival, despite not even having played their first game?... that Cave Johnson Couts was separately acquitted for shooting his foreman, firing on funeral mourners, and whipping a native laborer to death?... that characters' scars in an episode of The Last of Us were made with a paste-based appliance and a food mixer? ArchiveStart a new articleNominate an articleNgg wa Thiong'oKenyan writer and activist Ngg wa Thiong'o (pictured) dies at the age of 87.In sumo, nosato Daiki is promoted to yokozuna.In association football, Liverpool win the Premier League title.In motor racing, lex Palou wins the Indianapolis 500.Ongoing: Gaza warM23 campaignRussian invasion of UkrainetimelineSudanese civil wartimelineRecent deaths: Phil RobertsonMary K. GaillardPeter DavidAlan YentobGerry ConnollySebastio SalgadoNominate an articleMay 30: Statehood Day in Croatia (1990)Johann Sebastian Bach1431 Hundred Years' War: After being convicted of heresy, Joan of Arc was burned at the stake in Rouen, France.1723 Johann Sebastian Bach (pictured) assumed the office of Thomaskantor in Leipzig, presenting the cantata Die Elenden sollen essen in St.Nicholas Church.1922 The Lincoln Memorial in Washington, D.C., featuring a sculpture of the sixteenth U.S. president Abraham Lincoln by Daniel Chester French, opened.1963 Buddhist crisis: A protest against pro-Catholic discrimination was held outside the National Assembly of South Vietnam in Saigon, the first open demonstration against President Ng nh Dim.2008 The Convention on Cluster Munitions, prohibiting the use, transfer, and stockpiling of cluster bombs, was adopted.Ma Xifan (d.947)Colin Blythe (b.1879)Norris Bradbury (b.1909)Wynonna Judd (b.1964)More anniversaries: May 29May 30May 31ArchiveBy emailList of days of the yearAboutSeventeen performing "Oh My!" in 2018South Korean boy band Seventeen made their debut on May 26, 2015, when they performed a showcase for their debut EP 17 Carat in front of a crowd of 1,000 people. Since then, the group have held 9 concert tours, 13 fan meetings, and have performed at a number of music festivals and awards shows. Their concert tours include the Right Here World Tour, which sold over one million tickets, and the Follow Tour, which was noted by Billboard as being the top grossing K-pop tour of 2023. In 2024, Seventeen made their first appearances at festivals in Europe, when they were the first South Korean act to perform at Glastonbury Festival's Pyramid Stage and as headliners for Lollapalooza Berlin. Seventeen's live performances are well regarded by fans and critics alike, and garnered them the award for Top K-pop Touring Artist at the 2024 Billboard Music Awards. (Fulllist...)Recently featured: Accolades received by Top Gun: MaverickNational preserve76th Primetime Emmy AwardsArchiveMore featured listsIgnace Tonen (1840 or 1841 15 March 1916), also known as Nias or by his Ojibwe name Maiagizis ('right/correct sun'), was a Teme-Augama Anishnabai chief, fur trader, and gold prospector in Upper Canada. He was a prominent employee of the Hudson's Bay Company. Tonen was the elected deputy chief before being the lead chief and later the life chief of his community. In his role as deputy, he negotiated with the Canadian federal government and the Ontario provincial government, advocating for his community to receive annual financial support from both. His attempts to secure land reserves for his community were thwarted by the Ontario premier Oliver Mowat. Tonen's prospecting triggered a 1906 gold rush and the creation of Kerr Addison Mines Ltd., although one of his claims was stolen from him by white Canadian prospectors. This photograph shows Tonen in 1909.Photograph credit: William John Winter; restored by Adam CuerdenRecently featured: Australian white ibisHell Gate BridgeAnemonoides blandaArchiveMore featured picturesCommunity portal The central hub for editors, with resources, links, tasks, and announcements.Village pump Forum for discussions about Wikipedia itself, including policies and technical issues.Site news Sources of news about Wikipedia and the broader Wikimedia movement.Teahouse Ask basic questions about using or editing Wikipedia.Help desk Ask questions about using or editing Wikipedia.Reference desk Ask research questions about encyclopedic topics.Content portals A unique way to navigate the encyclopedia.Wikipedia is written by volunteer editors and hosted by the Wikimedia Foundation, a non-profit organization that also hosts a range of other volunteer projects: CommonsFree media repository MediaWikiWiki software development Meta-WikiWikimedia project coordination WikibooksFree textbooks and manuals WikidataFree knowledge base WikinewsFree-content news WikiquoteCollection of quotations WikisourceFree-content library WikispeciesDirectory of species WikiversityFree learning tools WikivoyageFree travel guide WiktionaryDictionary and thesaurusThis Wikipedia is written in English. Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles DeutschEspaolFranaisItalianoNederlandsPolskiPortugusSvenskaTing Vit 250,000+ articles Bahasa IndonesiaBahasa MelayuBn-lm-gCataletinaDanskEestiEsperantoEuskaraMagyarNorsk bokmlRomnSimple EnglishSloveninaSrpskiSrpskohrvatskiSuomiTrkeOzbekcha 50,000+ articles AsturianuAzrbaycancaBosanskiFryskGaeilgeGalegoHrvatskiKurdLatvieuLietuviNorsk nynorskShqipSlovenina Retrieved from " 2EP by Seventeen17 CaratEP by SeventeenReleasedMay29,2015(2015-05-29)GenreK-popdance-pophip hopLength16:48LanguageKoreanLabelPledis EntertainmentLOEN EntertainmentSeventeen chronology17 Carat(2015)Boys Be(2015)Singles from 17 Carat "Adore U"Released: May 29, 201517 Carat is the debut extended play (EP) by South Korean boy group Seventeen. It was released on May 29, 2015, by Pledis Entertainment and distributed by LOEN Entertainment. "Adore U" serves as the lead single for the EP.17 Carat features five tracks written, co-written, and co-produced by Seventeen's group members. "Adore U" was chosen as the lead single for the EP and was performed on multiple music shows by the group. "Shining Diamond" was used as a pre-single on the group's reality debut show. The group stated that the tracklist was chosen to reflect Seventeen's core concept of "boys' passion".[1] The album has two physical versions: one with a "black" themed photo card set, and the other with a "white" themed photo card set. All copies include a CD containing the songs and a fold-up poster/lyric sheet."Adore U" is the lead single of the extended play. It was written by Woozi, S.Coups, and Yeon Dong-geon.[2] The Korea Herald states "'Adore U' is a funky pop song about a teenage boy trying to navigate through puppy love."[3] It marks the beginning of the group's trilogy composed of the singles Adore U, Mansae, and Pretty U about a boy meeting, falling in love and asking out a girl. The track was composed and arranged by Woozi, Bumzu, and Yeon Dong-geon. The music video for the single was released on May 29, 2015, and was directed by Dee Shin. The dance choreography accompaniment to the song was choreographed by Hoshi and focuses on "storytelling, and on highlighting each member's strengths onstage".[4] The single has sold more than 38,000 digital copies and peaked at number 13 on the Billboard US World Chart.The EP has sold over 82,972 copies in South Korea.[5] It peaked at number 4 on the Korean Gaon Album Chart[6] and number 8 on the US World Billboard Chart.[7]Year-end listsCritic/publicationListRankRef.BillboardThe 10 Best K-pop Album of 2015Placed[8]Hoshi participated in the choreography of "Adore U" and "Shining Diamond", Dino choreographed "Jam Jam".[9]Official track list[10]No.TitleLyricsMusicArrangementsLength1."Shining Diamond"WooziVernonS.CoupsKim Min-jeongWooziMasterKeyRishiMasterKeyRishi3:242.""Adore U"" (; Akkinda)WooziVernonS.CoupsBumzuWooziBumzuYeon Dong-geonWooziBumzuYeon Dong-geon3:073."Ah Yeah" (Hip-Hop unit)S.CoupsVernonWonwooMingyuCream DoughnutRishiCream DoughnutRishi3:294."Jam Jam" (Performance unit + Vernon)WooziHoshiDinoVernonWooziCream DoughnutCream Doughnut3:255."20" (Vocal unit)WooziWooziWon Yeong-heonWon Yeong-heonDong Ne-hyeong3:23Weekly chart performance for 17 CaratChart (2015-2023)PeakpositionJapanese Albums (Oricon)[11]46South Korean Albums (Gaon)[12]4US World Albums (Billboard)[13]8Year-end chart performance for 17 CaratChart (2015)PeakpositionSouth Korean Albums (Gaon)[14]47^ "Seventeen hopes to shine like diamonds with '17 Carat'". 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Retrieved February 17, 2024.Retrieved from " 3The following pages link to 17 Carat External tools(link counttransclusion countsorted list) See help page for transcluding these entriesShowing 50 items.View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Main Page (links | edit)Pledis Entertainment discography (links | edit)List of 2015 albums (links | edit)2015 in South Korean music (links | edit)Seventeen (South Korean band) (links | edit)S.Coups (links | edit)Vernon (rapper) (links | edit)Wonwoo (links | edit)List of awards and nominations received by Seventeen (links | edit)Seventeen discography (links | edit)Love & Letter (links | edit)Joshua (singer) (links | edit)Seventeen TV (links | edit)17 carat (redirect page) (links | edit)Going Seventeen (links | edit)List of Seventeen live performances (links | edit)Teen, Age (links | edit)Al1 (links | edit)Bumzu (links | edit)Boys Be (EP) (links | edit)You Make My Day (links | edit)You Made My Dawn (links | edit)Jun (Chinese entertainer) (links | edit)List of Stray Kids live performances (links | edit)The8 (links | edit)An Ode (links | edit)Seungkwan (links | edit)Fallin' Flower (links | edit)Heng:gar (links | edit)Semicolon (EP) (links | edit)Your Choice (links | edit)Going Seventeen (web series) (links | edit)Not Alone (Seventeen song) (links | edit)Attacca (EP) (links | edit)Rock with You (Seventeen song) (links | edit)Woozi (links | edit)Hoshi (South Korean singer) (links | edit)Don't Wanna Cry (Seventeen song) (links | edit)Darl+ing (links | edit)Face the Sun (links | edit)Left & Right (Seventeen song) (links | edit)24H (EP) (links | edit)We Make You (links | edit)Hot (Seventeen song) (links | edit)Dream (Seventeen EP) (links | edit)BSS (band) (links | edit)FML (EP) (links | edit)Super (Seventeen song) (links | edit)Always Yours (album) (links | edit)Seventeenth Heaven (links | edit)View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Retrieved from " WhatLinksHere/17_Carat"Report this resourceto let us know if it violates our terms and conditions. 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