Pew Research Center

FOR RELEASE MARCH 28, 2019

What Americans Know About Science

Science knowledge levels remain strongly tied to education; Republicans and Democrats are about equally knowledgeable

BY *Brian Kennedy and Meg Hefferon*

FOR MEDIA OR OTHER INQUIRIES:

Cary Funk, Director, Science and Society Research
Shawnee Cohn, Communications Manager

202.419.4372

www.pewresearch.org

RECOMMENDED CITATION

Pew Research Center, March 2019, "What Americans Know About Science"

About Pew Research Center

Pew Research Center is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping America and the world. It does not take policy positions. The Center conducts public opinion polling, demographic research, content analysis and other data-driven social science research. It studies U.S. politics and policy; journalism and media; internet, science and technology; religion and public life; Hispanic trends; global attitudes and trends; and U.S. social and demographic trends. All of the Center's reports are available at www.pewresearch.org. Pew Research Center is a subsidiary of The Pew Charitable Trusts, its primary funder.

What Americans Know About Science

Science knowledge levels remain strongly tied to education; Republicans and Democrats are about equally knowledgeable

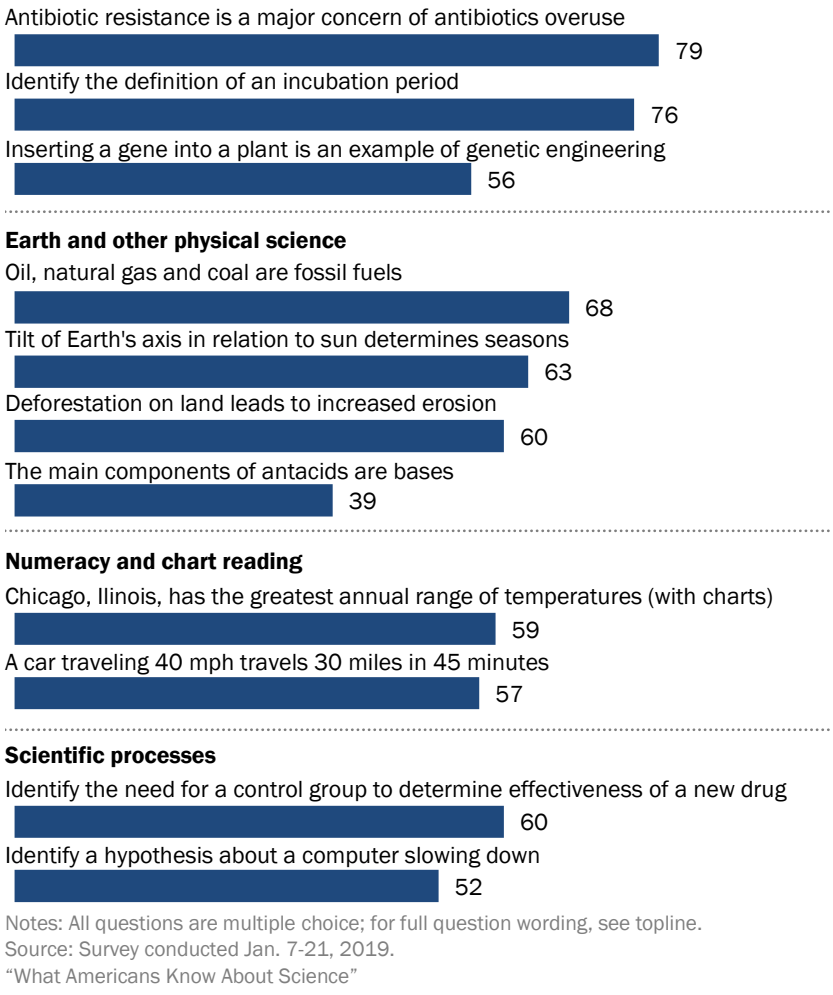
A new Pew Research Center survey finds that many Americans can answer at least some questions about science concepts – most can correctly answer a question about antibiotics overuse or the definition of an "incubation period," for example. But other concepts are more challenging; fewer Americans can recognize a hypothesis or identify that bases are the main components of antacids.

The survey, conducted Jan. 7 to 21, 2019, takes stock of the degree to which the public shares a common understanding of science facts and processes in an era of easy access to information and sometimes-intense debate over what information is true and false.

Americans' knowledge of specific facts connected with life sciences and earth and other physical sciences varies, of course. About eight-in-ten (79%) correctly identify that antibiotic resistance is a major concern about the overuse of antibiotics. A similar share (76%) know an incubation period is the time during which someone has an infection but is not showing symptoms.

What Americans know and don't know about science

% of U.S. adults who answer each question correctly



Notes: All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

除《企业家第一课》、《企业家功成堂》外，其他公众号分享本期资料的，均属于抄袭！

邀请各位读者朋友尊重劳动成果，关注搜索正版号：《企业家第一课》、《企业家功成堂》

谢谢观看！

企业家第一课，专注做最纯粹的知识共享平台

关注官方微信
获取更多干货

加入知识共享平台
一次付费 一年干货

The most challenging question in the set: What are the main components of antacids that help relieve an overly acidic stomach? About four-in-ten correctly answer bases (39%).

Americans give more correct than incorrect answers to the 11 questions. The mean number of correct answers is 6.7, while the median is 7. About four-in-ten Americans (39%) get between nine and 11 correct answers, classified as having high science knowledge on the 11-item scale or index. Roughly one-third (32%) are classified as having medium science knowledge (five to eight correct answers) and about three-in-ten (29%) are in the low science knowledge group (zero to four correct answers).

Science covers numerous fields and encompasses a vast amount of information, and the index of science knowledge can cover only a small slice of this information. However, the rationale for the scale stems from the fact people who happen to know more from this set of questions are also likely to know more about the vast array of science information, generally.

One goal for a useful scale or index of this sort is that it differentiates between individuals at each level of knowledge, particularly between those with a high level of knowledge and those with medium or low knowledge.[1] Item-response modeling suggests that the scale generally performs well in this regard. [2] See the Methodology for details.

More-educated Americans score highest on science knowledge; whites generally score higher than blacks and Hispanics

There are striking differences in levels of science knowledge by education as well as by racial and ethnic group. Men tend to score higher than women on the science knowledge scale, but gender differences are not consistent across questions in the scale. And political party groups are roughly similar in their overall levels of science knowledge, although conservative Republicans and liberal Democrats tend to score higher on the scale than do their more moderate counterparts.

[1] See Kahan, Dan M. 2015. "Climate-Science Communication and the Measurement Problem." Advances in Political Psychology.
[2] Performance on a previous science knowledge index (with nine different questions) is highly correlated with scores on the new index. This suggests that the new scale is a reliable indicator of science knowledge and is not highly dependent on specific questions in the scale.

There are wide educational differences on science knowledge

Americans with a postgraduate degree get about four more questions correct, on average, than those with a high school degree or less education (9.1 of 11 questions vs. 5 of 11). Roughly seven-in-ten (71%) Americans with a postgraduate degree are classified as high in science knowledge, answering at least nine of 11 items correctly. By contrast, about two-in-ten (19%) of those with a high school degree or less perform as well on the scale.

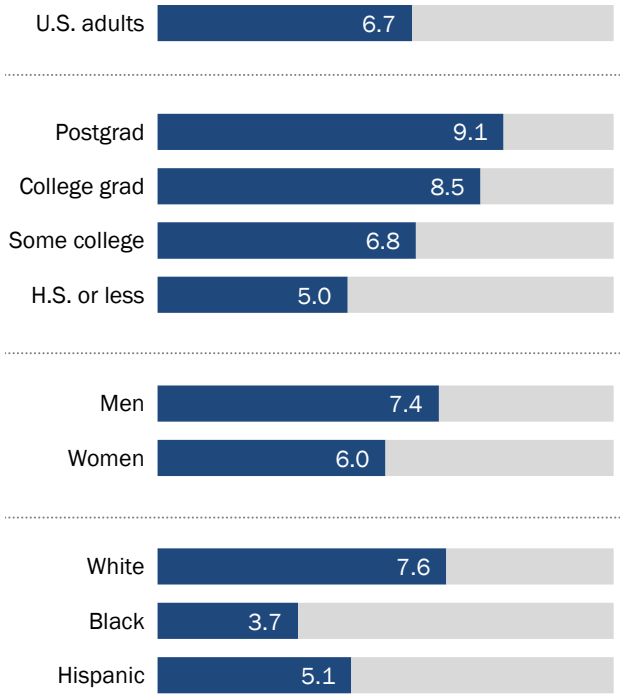
And on each of the 11 questions, those with a postgraduate degree are at least 27 percentage points more likely to choose the correct answer than those with a high school degree or less.

These large education differences are consistent with past Center surveys on science knowledge and with the National Science Board's index of factual science knowledge. [3]

Wide differences in science knowledge on education may reflect greater exposure to science training at higher levels of schooling. People may also encounter science information informally by going to museums or zoos or through participation in science-related activities. A 2017 Pew Research Center survey found that 62% of U.S. adults had encountered science through one of these informal institutions or events in the past year: a national, state or county park (47%); a zoo or aquarium (30%); a science and technology center or museum (18%); a natural history museum (16%); or a science lecture (10%). Those with more education were also more likely to have participated in any of these informal science activities.

More educated Americans score higher on the science knowledge scale

Mean number of correct answers out of 11



Notes: Whites and blacks include only non-Hispanics. Hispanics are of any race. All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

[3] National Science Board. 2018. "Science and Technology: Public Attitudes and Understanding." Science & Engineering Indicators 2018.

News media can also inform people about science and new scientific developments. Most Americans (71%) reported they were at least somewhat interested in science news in the same 2017 Center survey, though 68% of Americans said they were more likely to get science news because they happen to come across it, while 30% said they seek it out. Americans with more education were more likely than those with a high school degree or less education to report that they seek out science news.

There are substantial differences in levels of science knowledge by race and ethnicity

Whites are more likely than Hispanics or blacks to score higher on the index. Whites get an average of 7.6 correct out of 11 questions, while Hispanics average 5.1 correct answers and blacks 3.7 correct answers.[4] Roughly half of whites (48%) are classified as having high science knowledge on the scale, answering at least nine questions correctly, compared with 23% of Hispanics and 9% of blacks.

Differences by race and ethnicity on science knowledge could be tied to several factors such as educational attainment and access to science information. However, differences between the racial/ethnic groups on science knowledge hold even after controlling for education levels in a regression model.

Previous Pew Research Center surveys have also found differences between whites, blacks and Hispanics on science knowledge questions. Similarly, Center analysis of the factual science knowledge questions from the General Social Surveys (GSS) conducted between 2006 and 2016 found that, on average, whites got 6.1 out of 9 correct answers, while blacks got 4.4 correct answers and Hispanics got 4.8 correct answers.[5] Among those with a college degree or more, on average, whites had 1.6 more correct answers than blacks and 0.8 more correct answers than Hispanics. These differences are consistent with findings from Nick Allum and colleagues who used a regression analysis with additional controls for socioeconomic status.[6]

Black and Hispanic students also tend to score lower on standardized tests on science at the elementary and high school levels, even as these achievement gaps have narrowed over time. And a Pew Research Center analysis of the 2015 National Assessment of Educational Progress found whites were more likely than blacks and Hispanics to express interest in science in high school.

[4] Among Hispanics born in the U.S., the mean is 5.7 correct out of 11 items.
[5] Among U.S.-born Hispanics, the mean was 5.2 out of 9 correct answers. The analysis pooled across numerous years of the GSS to get the largest possible samples of blacks (n=1,008) and Hispanics (n=899).
[6] See Allum, Nick, John Besley, Louis Gomez and Ian Brunton-Smith. May 25, 2018. "Disparities in science literacy." Science.

Men tend to score higher than women on science knowledge, but the differences vary across questions

The survey also finds men generally score higher than women on the science knowledge scale. On average, men answer 7.4 questions correctly, while women average 6.0. About half of men (49%) score high on the scale, compared with 30% of women. But gender differences are not consistent across questions.

Science and Engineering Indicators reports over the past several years have suggested that men tend to do better on knowledge of physical science facts while men and women perform about equally on facts related to the life sciences.[7] The Center survey includes only a handful of questions in each domain. Men are more likely than women to answer the four questions related to earth and other physical sciences correctly. Two of the three questions related to life sciences in the survey find men and women are about equally likely to know the correct response. For example, 80% of men and 77% of women correctly say that antibiotic resistance is a major concern of overuse of antibiotics.

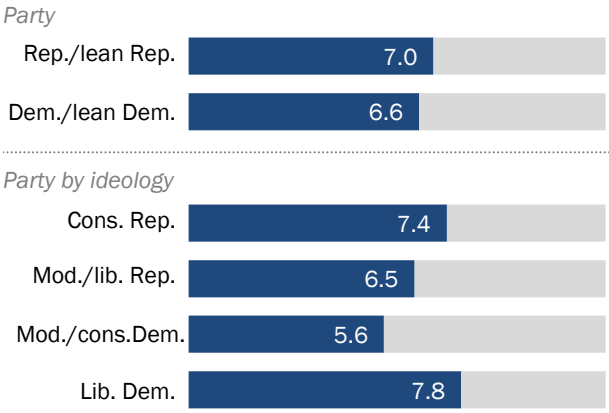
Republicans and Democrats hold similar levels of science knowledge

Republicans and Democrats have similar levels of understanding about science, in contrast to the wide differences by education and racial and ethnic group. Republicans and independents who lean to the Republican Party average seven correct answers, while Democrats and independents who lean to the Democratic Party average 6.6.

Those at the ends of the political spectrum – liberal Democrats and conservative Republicans – score higher than those in the middle, however. On average, liberal Democrats get 7.8 correct answers and conservative Republicans score 7.4. In comparison,

Conservative Republicans and liberal Democrats score higher on science knowledge

Mean number of correct answers out of 11



Notes: Republicans and Democrats include independents and others who "lean" toward the parties. All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

[7] On a different knowledge scale that included an expanded set of biology facts, men outperformed women (see the 2010 Science and Engineering Indicators). Their biennial reports also find no difference between men and women on measures tapping public understanding of the scientific process.

moderate and liberal Republicans get an average of 6.5 correct answers, while moderate and conservative Democrats get an average of 5.6.

These findings are consistent with a 2016 Center survey that used a different science knowledge scale and also found partisans to hold similar levels of science knowledge. That study found a tendency for liberal Democrats and, to a lesser extent, conservative Republicans to score higher on the scale than those in the middle of the political spectrum.

Older and younger Americans have roughly similar scores on the science knowledge index

Science knowledge levels are similar by age, although there are some differences across questions on the scale. On average, those ages 65 and older get 7.1 out of 11 questions correct and those ages 18 to 29 get 6.6 correct. In statistical models predicting science knowledge and controlling for gender, race/ethnicity and education, there are no significant differences by age (see Appendix for more details). Past Center surveys also found age patterns in science knowledge tended to vary across questions.

Details on education, race and ethnicity, gender, and political party differences are shown in the Appendix.

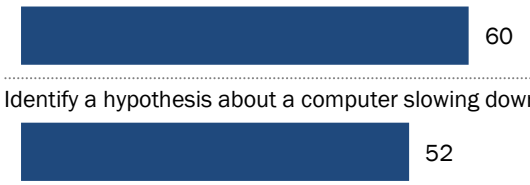
Public understanding of the scientific method also connects with education levels

People's understanding of scientific processes and how scientific knowledge accumulates may help them navigate ongoing debates over science connected with issues such as climate change, childhood vaccines and genetically modified foods.

The survey includes two questions designed to test understanding of scientific processes. Six-in-ten Americans (60%) can identify that adding a control group is the best of four options to use to test whether an ear infection medication is effective. And 52% correctly identify a scientific hypothesis about a computer slowing down.

Half can recognize a hypothesis about a problem in everyday life

% of U.S. adults who answer each question correctly



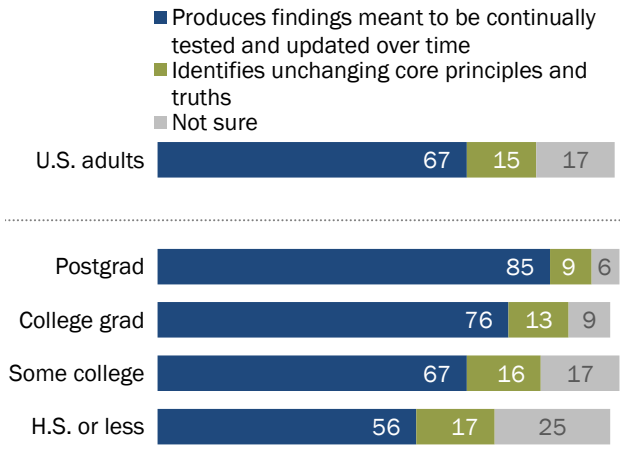
Note: All questions are multiple choice; for full question wording, see topline. Respondents who did not give an answer are not shown.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

One other question, not included as part of the scale, asked survey respondents which of two statements best describes the scientific method: That it produces findings meant to be continually tested and updated over time, or that it identifies unchanging core principles and truths. Two-thirds of Americans (67%) say the scientific method is designed to be iterative, producing findings that are continually tested and updated, while 15% say the method produces unchanging core principles and truths, and 17% say they are not sure.

67% of Americans see the scientific method as an iterative process

% of U.S. adults who say the scientific method ...



Note: Respondents who did not give an answer are not shown.
Source: Survey conducted Jan 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Americans with higher levels of education are more inclined to see the scientific method as producing results that are meant to be continually tested and updated over time. Three-quarters or more of those with a postgraduate (85%) or college degree (76%) say this, compared with 56% among those with a high school education or less.

Science knowledge is often hailed as important for society, but its role in public attitudes can be nuanced

Higher levels of science knowledge are often seen as important characteristics for individuals, communities and the citizenry as a whole.[8]

As a practical matter, science knowledge can help individuals navigate a variety of everyday situations, such as making health care decisions or deciding what to eat. Communities can benefit from higher levels of science knowledge, particularly as they make sense of potential health hazards in their environment. And, as science continues to advance and new scientific debates emerge on issues such as climate change and gene editing, a more informed citizenry is seen as better able to make sense of this information and engage in civic discourse around these topics.

Many in the scientific community have looked to public knowledge and understanding about science as a potential driver of support for specific positions that align with scientific consensus in areas of "settled science." But a long history of research in pursuit of what is often called a "deficit

[8] The National Academies of Sciences, Engineering and Medicine. 2016. "Science Literacy: Concepts, Contexts and Consequences."

model" of public attitudes finds little support for the idea. A meta-analysis of past research has shown a modest positive relationship between science knowledge and people's general support for science or scientific research.[9] However, levels of science knowledge do not typically have a direct relationship with positions on specific issues, such as whether to mandate the vaccine for measles, mumps and rubella for children who attend public schools.

And on some issues, science knowledge can have a more complicated, indirect role. When it comes to public views about climate and energy issues, partisanship appears to serve as an anchoring point in how people apply their knowledge.[10] For example, a 2016 Pew Research Center survey found that 93% of Democrats with a high level of knowledge about science said climate change is mostly due to human activity, compared with about half (49%) of Democrats with low science knowledge who said this. By contrast, Republicans with a high level of science knowledge were no more likely than those with a low level of knowledge to think climate change is mostly due to human activity. The same pattern was found for people's beliefs about energy issues.

While public understanding of science remains important for individuals, communities and societies, such findings highlight the often nuanced role of information in public attitudes.

[9] Allum, Nick, Patrick Sturgis, Dimitra Tabourazi and Ian Brunton-Smith. 2008. "Science knowledge and attitudes across cultures: a meta-analysis." Public Understanding of Science. Also see Chapter 2, "The Complexities of Communicating Science" in National Academies of Sciences, Engineering and Medicine. 2017. "Communicating Science Effectively: A Research Agenda." Also see Rose, Kathleen M., Emily L. Howell, Leona Y-F Su, Michael A. Xenos, Dominique Brossard and Dietram A. Scheufele. 2019. "Distinguishing scientific knowledge: The impact of different measures of knowledge on genetically modified food attitudes." Public Understanding of Science.

[10] Scholarly research also has shown that the influence of education or science knowledge can vary across the two political parties, consistent with a model of motivated reasoning. See for example, Kahan, Dan, Asheley R. Landrum, Katie Carpenter, Laura Helft, and Kathleen Hall Jamieson. 2017. "Science Curiosity and Political Information Processing." Advances in Political Psychology. Also see Gauchat, Gordon. 2012. "Politicization of Science in the Public Sphere: A Study of Public Trust in the United States, 1974-2010." American Sociological Review.

Acknowledgments

This report is made possible by The Pew Charitable Trusts. It is a collaborative effort based on the input and analysis of the following individuals. Find related reports online at: pewresearch.org/science.

Primary research team

Cary Funk, *Director, Science and Society Research*
Brian Kennedy, *Research Associate*
Meg Hefferon, *Research Analyst*
Cary Lynne Thigpen, *Research Assistant*

Editorial and graphic design

Aleksandra Sandstrom, *Copy Editor*
Margaret Porteus, *Information Graphics Designer*

Communications and web publishing

Shawnee Cohn, *Communications Manager*
Haley Nolan, *Communications Associate*
Sara Atske, *Assistant Digital Producer*

Methodology

The American Trends Panel survey methodology

The American Trends Panel (ATP), created by Pew Research Center, is a nationally representative panel of randomly selected U.S. adults. Panelists participate via self-administered web surveys. Panelists who do not have internet access at home are provided with a tablet and wireless internet connection. The panel is managed by Ipsos.

Data in this report are drawn from the panel wave conducted Jan. 7 to Jan. 21, 2019. A stratified random sample of 5,817 panelists was selected from the full panel. Of these, 4,464 panelists responded for a response rate of 77%. The subsample was selected by grouping panelists into five strata so demographic groups that are underrepresented in the panel had a higher probability of selection than overrepresented groups:

American Trends Panel recruitment surveys

Recruitment Dates	Mode	Invited	Joined	Active panelists remaining
Jan. 23 to March 16, 2014	Landline/ cell RDD	9,809	5,338	2,515
Aug. 27 to Oct. 4, 2015	Landline/ cell RDD	6,004	2,976	1,471
April 25 to June 4, 2017	Landline/ cell RDD	3,905	1,628	806
Aug. 8, 2018–Oct. 31, 2018	ABS/web	9,396	8,778	8,777
	Total	**29,114**	**18,720**	**13,569**

Note: Approximately once per year, panelists who have not participated in multiple consecutive waves or who did not complete an annual profiling survey are removed from the panel. Panelists also become inactive if they ask to be removed from the panel.

PEW RESEARCH CENTER

- Stratum A consists of panelists who are non-internet users. They were sampled at a rate of 100%.
- Stratum B consists of panelists with a high school or less education. They were sampled at a rate of 100%.
- Stratum C consists of panelists that are Hispanic, unregistered or non-volunteers. They were sampled at a rate of 54%.
- Stratum D consists of panelists that are black or 18 to 34 years old. They were sampled at a rate of 16%.
- Stratum E consists of the remaining panelists. They were sampled at a rate of 5%.

Panelists were grouped into these strata in hierarchical order from A to E. For example, a panelist who is not registered to vote and has a high school education or less would be in Stratum B rather than in Stratum C.

Accounting for nonresponse, the cumulative response rate to the recruitment surveys and attrition is 5.6%. The margin of sampling error for the full sample of 4,464 respondents is plus or minus 1.9 percentage points.

The ATP was created in 2014, with the first cohort of panelists invited to join the panel at the end of a large national landline and cellphone random-digit-dial survey that was conducted in both English and Spanish. Two additional recruitments were conducted using the same method in 2015 and 2017, respectively. Across these three surveys, a total of 19,718 adults were invited to join the ATP, of whom 9,942 agreed to participate.

In August 2018, the ATP switched from telephone to address-based recruitment. Invitations were sent to a random, address-based sample (ABS) of households selected from the U.S. Postal Service's Delivery Sequence File. In each household, the adult with the next birthday was asked to go online to complete a survey, at the end of which they were invited to join the panel. For a random half-sample of invitations, households without internet access were instructed to return a postcard. These households were contacted by telephone and sent a tablet if they agreed to participate. A total of 9,396 were invited to join the panel, and 8,778 agreed to join the panel and completed an initial profile survey.

Of the 18,720 individuals who have ever joined the ATP, 13,569 remain active panelists and continue to receive survey invitations.

Weighting

The ATP data were weighted in a multistep process that begins with a base weight incorporating the respondents' original survey selection probability and the fact that in 2014 and 2017 some respondents were subsampled for invitation to the panel. The next step in the weighting uses an iterative technique that aligns the sample to population benchmarks on the dimensions listed in the accompanying table.

Weighting dimensions

Variable	Benchmark source
Gender	2017 American Community Survey
Age	
Education	
Internet access	
Race/Hispanic origin	
Hispanic nativity	
Region x Metropolitan status	2018 CPS March Supplement
Volunteerism	2015 CPS Volunteer Supplement
Voter registration	2016 CPS Voting and Registration Supplement
Party affiliation	Average of the three most recent Pew Research Center telephone surveys.

Note: Estimates from the ACS are based on non-institutionalized adults. Voter registration is calculated using procedures from Hur, Achen (2013) and rescaled to include the total US adult population.

PEW RESEARCH CENTER

Sampling errors and statistical significance tests take into account the effect of weighting. Interviews are conducted in both English and Spanish, but the American Trends Panel's Hispanic sample is predominantly U.S. born and English-speaking.

In addition to sampling error, one should bear in mind that question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of opinion polls.

The following table shows the unweighted sample sizes and the error attributable to sampling that would be expected at the 95% level of confidence for different groups in the survey:

Sample sizes and sampling errors for other subgroups are available upon request.

Margins of error

	Sample size	Margin of error in percentage points
U.S. adults	4,464	+/- 1.9
Men	1,960	+/- 2.9
Women	2,500	+/- 2.6
Race/ethnicity		
White	2,891	+/- 2.3
Black	506	+/- 5.5
Hispanic	718	+/- 5.3
Postgrad	671	+/- 4.9
College grad	903	+/- 4.3
Some college	1,250	+/- 3.6
H.S. or less	1,630	+/- 3.2
18-29	738	+/- 4.8
30-49	1,449	+/- 3.3
50-64	1,295	+/- 3.6
65+	978	+/- 4.0
Republican/lean Rep.	1,785	+/- 3.0
Democrat/lean Dem.	2,459	+/- 2.6
Conservative Republican	1,129	+/- 3.8
Mod/lib Republican	643	+/- 5.1
Mod/cons Democrat	1,269	+/- 3.6
Liberal Democrat	1,173	+/- 3.7

Note: The margins of error are reported at the 95% level of confidence and are calculated by taking into account the average design effect for each subgroup. Republicans and Democrats include independents and others who "lean" toward the parties.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Measurement properties of the science knowledge scale

Pew Research Center's survey on science knowledge covers knowledge of facts connected with life sciences, earth and other physical sciences, numeracy and understanding of scientific processes.

The following criteria are used to evaluate how well the 11 items can used as a scale or index of science knowledge more broadly: 1) the degree to which responses are internally consistent 2) the degree to which the questions reflect a single underlying latent dimension, and 3) the degree to which the scale discriminates between people with high and low knowledge, providing information about people with varying levels of science knowledge.

The internal reliability of the scale as measured by Cronbach's alpha is 0.86. Cronbach's alpha does not increase if any of the items are dropped.

Scale reliability and factor analysis

Science knowledge scale		Alpha for scale 0.86	Common variance explained by first factor 81%
	Item-rest correlation	Alpha if item is dropped	Factor loadings
KNOW1. Oil, natural gas and coal are examples of fossil fuels	0.56	0.84	0.61
KNOW2. Example showing the importance of a control group	0.53	0.84	0.58
KNOW3. Inserting a gene into plants that makes them resistant to insects is an example of genetic engineering	0.64	0.84	0.69
KNOW4. Tilt of the Earth's axis in relation to the sun is the main cause of seasons	0.52	0.85	0.56
KNOW5. Chicago, Illinois, has the greatest annual range of temperatures (with charts)	0.51	0.85	0.55
KNOW6. Identify an example of a hypothesis	0.51	0.85	0.55
KNOW7. Identify the definition of an incubation period	0.55	0.84	0.61
KNOW9. Increased erosion occurs due to deforestation	0.54	0.84	0.59
KNOW10. Antacids relieve an overly acidic stomach because the main components are bases	0.56	0.84	0.61
KNOW11. The major concern of the overuse of antibiotics is it can lead to antibiotic-resistant bacteria	0.55	0.84	0.61
KNOW12. A car traveling at a constant speed of 40 mph travels 30 miles in 45 minutes	0.54	0.84	0.58

Source: Survey conducted Jan. 7-21, 2019. "What Americans Know About Science"

PEW RESEARCH CENTER

An exploratory factor analysis finds that the first common factor explains 81% of the shared variance in the items. The second common factor explains only 9% of the common variance. The factor loadings show that each of the 11 items is at least moderately correlated with the first common factor. This suggests that the set of items is the result of a single underlying dimension.

Note that all the science knowledge items are coded as binary variables (either correct or incorrect). Both Cronbach's alpha and factor analysis are based on a Pearson's correlation matrix. Pearson's correlations with binary variables are restricted to a limited range, underestimating the association between two variables. We do not anticipate the use of a Pearson's correlation matrix will affect the unidimensional factor solution for the scale.

We conducted item response modeling for the scale to evaluate how well it discriminates between people at different levels of knowledge. The analysis fits a two-parameter logistic model, allowing discrimination and difficulty to vary across items.[11] Discrimination shows the ability of the question to distinguish between those with higher and lower science knowledge. Difficulty shows how easy or hard each question is for the average respondent.

Two-parameter item response theory analysis

	% correct	Difficulty	Discrimination
KNOW1. Oil, natural gas and coal are examples of fossil fuels	68	-0.62	2.08
KNOW2. Example showing the importance of a control group	60	-0.34	1.82
KNOW3. Inserting a gene into plants that makes them resistant to insects is an example of genetic engineering	56	-0.18	2.74
KNOW4. Tilt of the Earth's axis in relation to the sun is the main cause of seasons	63	-0.46	1.74
KNOW5. Chicago, Illinois, has the greatest annual range of temperatures (with charts)	59	-0.34	1.65
KNOW6. Identify an example of a hypothesis	52	-0.07	1.76
KNOW7. Identify the definition of an incubation period	76	-0.85	2.86
KNOW9. Increased erosion occurs due to deforestation	60	-0.34	1.95
KNOW10. Antacids relieve an overly acidic stomach because the main components are bases	39	0.34	2.44
KNOW11. The major concern of the overuse of antibiotics is it can lead to antibiotic-resistant bacteria	79	-0.93	2.93
KNOW12. A car traveling at a constant speed of 40 mph travels 30 miles in 45 minutes	57	-0.25	1.81

Source: Survey conducted Jan. 7-21, 2019. "What Americans Know About Science"

PEW RESEARCH CENTER

All the items have acceptable discrimination estimates. Two of the easiest items also have the two highest discrimination estimates: KNOW11 (the major concern of the overuse of antibiotics is it can lead to antibiotic-resistant bacteria) and KNOW7 (identify the definition of an incubation period). But one medium-difficulty item (KNOW3 – inserting a gene into plants that makes them resistant to insects is an example of genetic engineering) and one hard difficulty item (KNOW10 –

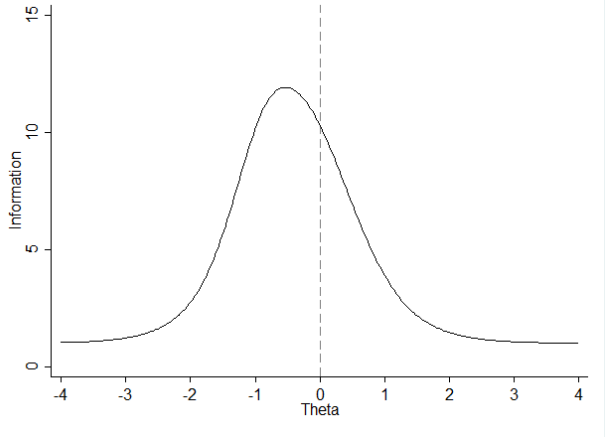
[11] A three-parameter model allowing for a pseudoguessing parameter somewhat improves model fit compared with a two-parameter model. However, the other parameters are nearly identical in the two- and three-parameter models; we present the two-parameter model for simplicity and parsimony.

antacids relieve an overly acidic stomach because the main components are bases) also have large discrimination estimates.

The difficulty parameter estimates are negative for 10 of the 11 items, and positive for one of the items. This shows that the average respondent had a good chance of getting the correct answer on most of the items.

The test information function shows the amount of information the scale provides about people with different levels of science knowledge. The test function approximates a normal curve and is centered below zero (Theta) at about -0.5. This indicates that the scale provides the most information about those with slightly below-average science knowledge. The scale provides comparatively less information about those with high science knowledge, especially those with *very* high levels of knowledge.

Test information function for science knowledge scale



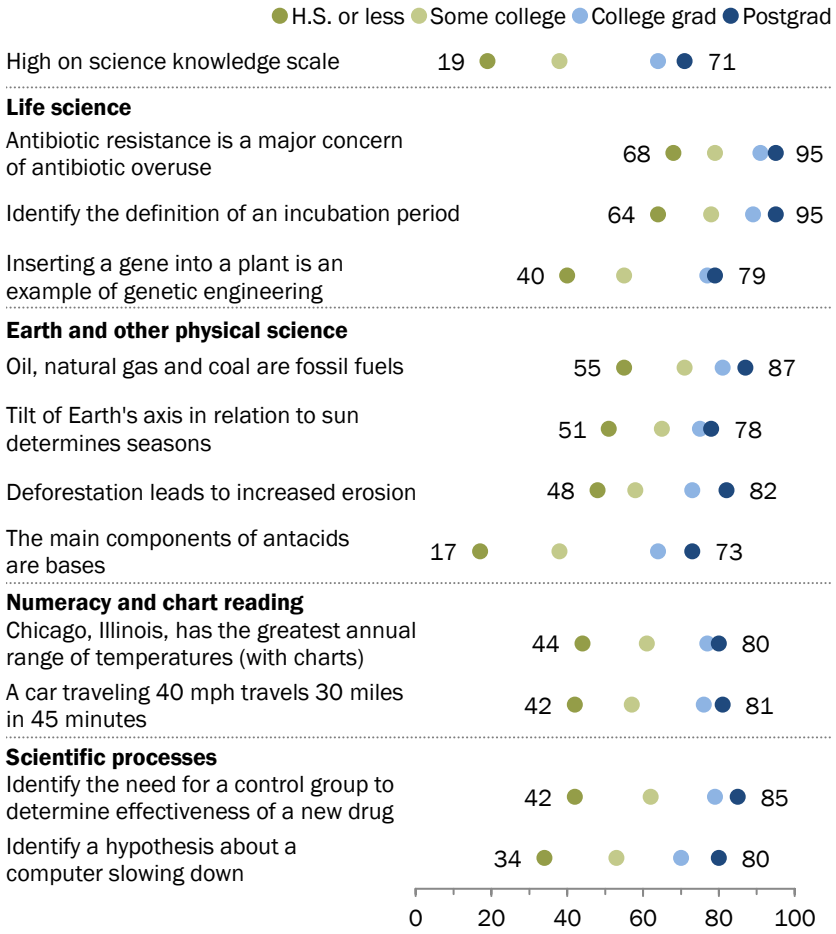
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Appendix: Detailed tables

Americans with more education perform better on each of the science knowledge questions

% of U.S. adults in each group who answer each question correctly

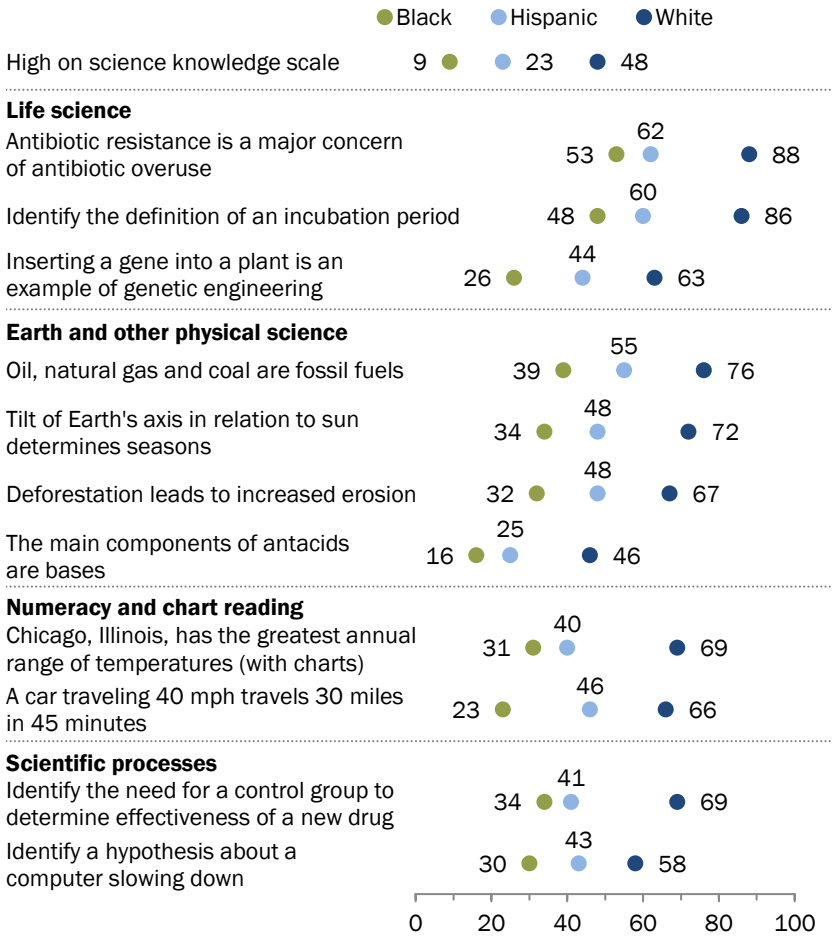


Note: All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Whites more likely than blacks and Hispanics to score high on the science knowledge scale

% of U.S. adults in each group who answer each question correctly

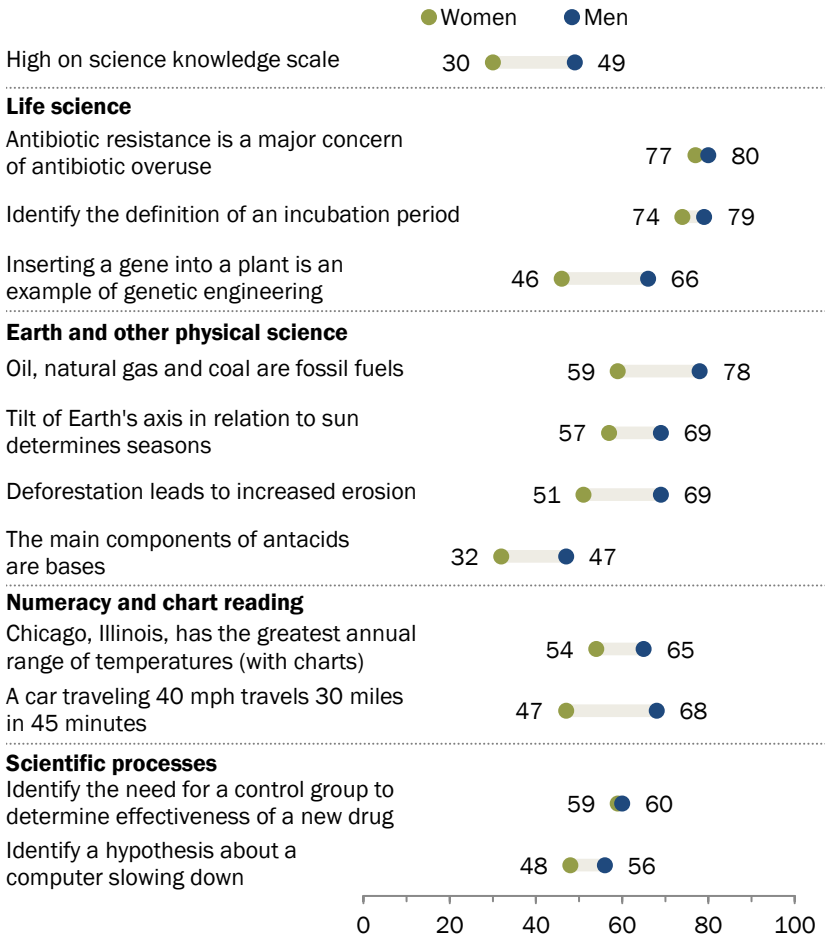


Note: Whites and blacks include only non-Hispanics; Hispanics are of any race. All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Men score somewhat higher than women on the science knowledge scale overall

% of U.S. adults in each group who answer each question correctly



Note: All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Republicans and Democrats are similar in their levels of science knowledge

% of U.S. adults who answer each question correctly

	Rep./ lean Rep.	Dem./ lean Dem.	Rep.-Dem. Diff.
High on science knowledge scale	40	41	+1
Life science			
Antibiotic resistance is a major concern of antibiotics overuse	84	76	+8
Identify the definition of an incubation period	82	74	+8
Inserting a gene into a plant is an example of genetic engineering	58	57	+1
Earth and other physical science			
Oil, natural gas and coal are fossil fuels	73	66	+7
Tilt of Earth's axis in relation to sun determines seasons	67	61	+6
Deforestation on land leads to increased erosion	64	59	+5
The main components of antacids are bases	38	41	-3
Numeracy and chart reading			
Chicago, Illinois, has the greatest annual range of temperatures (with charts)	63	59	+4
A car traveling 40 mph travels 30 miles in 45 minutes	61	56	+5
Scientific processes			
Identify the need for a control group to determine effectiveness of a new drug	62	59	+3
Identify a hypothesis about a computer slowing down	51	54	-3
Average number of correct overall	7.0	6.6	+0.4

Note: All questions are multiple choice; for full question wording, see topline.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Linear regression models predicting science knowledge score

Linear regression coefficients predicting score on science knowledge scale from 0 to 11 for each variable

	Model 1	Model 2
Woman	**-1.33**	**-1.31**
Race Reference category: White, non-Hispanic		
Black	**-3.40**	**-3.49**
Hispanic	**-1.84**	**-1.85**
Other or mixed race	**-0.88**	**-0.89**
Age Reference category: 65+		
Ages 18-29	+0.17	+0.13
Ages 30-49	-0.09	-0.07
Ages 50-64	-0.04	+0.02
Education Reference category: High school or less		
Some college	**+1.62**	**+1.60**
College graduate	**+3.18**	**+3.01**
Postgraduate degree	**+3.67**	**+3.40**
Political affiliation Reference category: Republican/lean Republican		
Democrat/lean Democratic	--	-0.07
No party affiliation or lean	--	**-0.94**
Ideology Reference category: Conservative		
Liberal	--	**+0.82**
Moderate	--	+0.07
Intercept	6.65	6.56
R-squared	0.36	0.37
Number of respondents	4,393	4,290

Note: Figures shown are linear regression coefficients. Positive and negative values indicate the direction of the effect. Bold indicates that the two-tailed p-value is <0.05. The independent variables are 0 or 1 such that a woman is compared with a man; black, Hispanic and other/mixed race compared with white; ages 18 to 29, ages 30 to 49 and ages 50 to 64 compared with age 65 and older; some college, college graduate and postgraduate degree compared with high school degree or less; Democrat/lean Democratic and no party affiliation compared with Republican/lean Republican; liberal and moderate compared with conservative.
Source: Survey conducted Jan. 7-21, 2019.
"What Americans Know About Science"

PEW RESEARCH CENTER

Survey question wording and topline

2019 PEW RESEARCH CENTER'S AMERICAN TRENDS PANEL
WAVE 42 JANUARY
FINAL TOPLINE
JANUARY 7-21, 2019
TOTAL N=4,464

OTHER QUESTIONS HELD FOR FUTURE RELEASE

ASK ALL:

KNOW1 Here's a different kind of question. (If you don't know the answer, select "Not sure.") As far as you know…

Oil, natural gas and coal are examples of…[12] **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
68	Fossil fuels (Correct)
32	NET Incorrect/Not sure/No answer
5	Biofuels
3	Geothermal resources
6	Renewable resources
17	Not sure
1	No answer

ASK ALL:

KNOW2 A scientist is conducting a study to determine how well a new medication treats ear infections. The scientist tells the participants to put 10 drops in their infected ear each day. After two weeks, all participants' ear infections had healed.

Which of the following changes to the design of this study would most improve the ability to test if the new medication effectively treats ear infections? **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
60	Create a second group of participants with ear infections who do not use any ear drops (Correct)
40	NET Incorrect/Not sure/No answer
5	Create a second group of participants with ear infections who use 15 drops a day
13	Have participants use ear drops for only 1 week
5	Have participants put ear drops in both their infected ear and healthy ear
16	Not sure
1	No answer

12 This question was adapted with permission from the Educational Testing Service (2018), The Praxis® Study Companion: Middle School Science 5440 – page 21, Sample Question #18. Copyright © 2018 Educational Testing Service.

ASK ALL:
KNOW3 Which of the following is an example of genetic engineering? **[RANDOMIZE OPTIONS 1-4]**

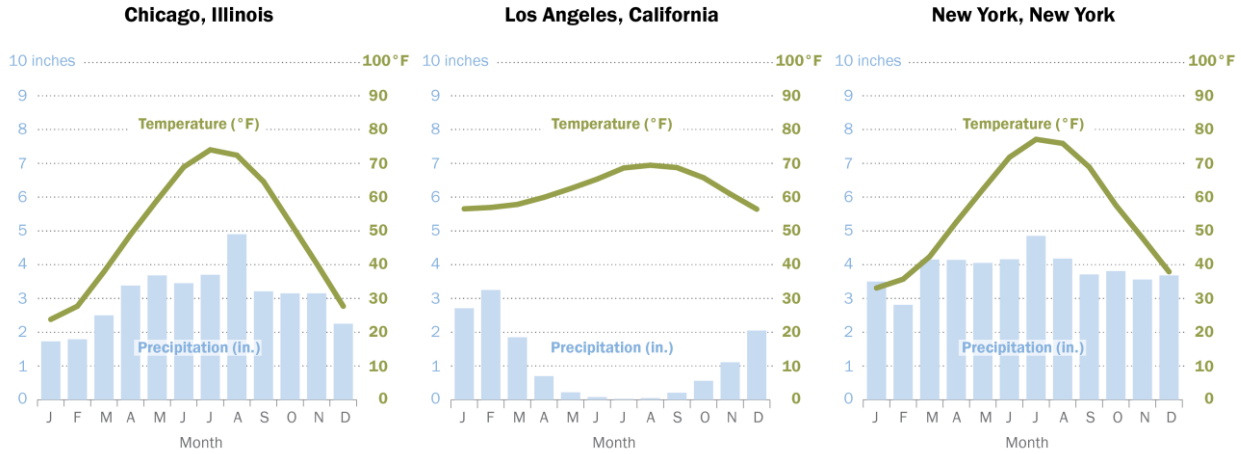
Jan 7-21 2019	
56	Inserting a gene into plants that makes them resistant to insects (Correct)
44	NET Incorrect/Not sure/No answer
6	Growing a whole plant from a single cell
8	Finding the sequences of bases in plant DNA
9	Attaching the root of one type of plant to the stem of another type of plant
21	Not sure
1	No answer

ASK ALL:
KNOW4 What is the main cause of seasons on the Earth? **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
63	The tilt of the Earth's axis in relation to the sun (Correct)
37	NET Incorrect/Not sure/No answer
11	The distance between the Earth and the sun
7	The speed that the Earth rotates around the sun
4	Changes in the amount of energy coming from the sun
15	Not sure
1	No answer

ASK ALL:

KNOW5 These graphs show the monthly precipitation and average temperature for three cities in the United States over the course of one year. **[RANDOMIZE ORDER OF GRAPHS]**



Based on the graphs, which city has the greatest annual range of temperatures? **[RANDOMIZE OPTIONS 1-3 IN SAME ORDER OF GRAPHS]**

Jan 7-21
2019

59	Chicago, Illinois (Correct)
41	NET Incorrect/Not sure/No answer
20	New York, New York
9	Los Angeles, California
3	They all have the same annual temperature range
8	Not sure
1	No answer

ASK ALL:

KNOW6 The time a computer takes to start has increased dramatically. One possible explanation for this is that the computer is running out of memory.

This explanation is a scientific… **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21
2019

52	Hypothesis (Correct)
48	NET Incorrect/Not sure/No answer
8	Conclusion
4	Experiment
19	Observation
17	Not sure
1	No answer

ASK ALL:

KNOW7 Many diseases have an incubation period. Which of the following best describes what an incubation period is? **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
76	The period during which someone has an infection, but is not showing symptoms (Correct)
24	NET Incorrect/Not sure/No answer
4	The recovery period after being sick
2	The effect of a disease on babies
5	The period during which someone builds up immunity to a disease
12	Not sure
1	No answer

NO QUESTION KNOW8

ASK ALL:

KNOW9 When large areas of forest are removed so land can be converted for other uses, such as farming, which of the following occurs?[13] **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
60	Increased erosion (Correct)
40	NET Incorrect/Not sure/No answer
3	Colder temperature
14	Decreased carbon dioxide
3	Greater oxygen production
20	Not sure
1	No answer

ASK ALL:

KNOW10 An antacid relieves an overly acidic stomach because the main components of antacids are… **[RANDOMIZE RESPONSE OPTIONS 1-4]**

Jan 7-21 2019	
39	Bases (Correct)
61	NET Incorrect/Not sure/No answer
11	Acids
13	Neutral
3	Isotopes
33	Not sure
1	No answer

[13] This question was adapted with permission from the Florida Department of Education (2012), Statewide Science Assessment Test Item Specifications, Version 2, Grade 8.

ASK ALL:
KNOW11 Which of these is a major concern about the overuse of antibiotics? **[RANDOMIZE OPTIONS 1-4]**

Jan 7-21 2019	
79	It can lead to antibiotic-resistant bacteria (Correct)
21	NET Incorrect/Not sure/No answer
2	There will be an antibiotic shortage
5	Antibiotics can cause secondary infections
2	Antibiotics will get into the water system
11	Not sure
1	No answer

ASK ALL:
KNOW12 A car travels at a constant speed of 40 miles per hour. How far does the car travel in 45 minutes? **[DO NOT RANDOMIZE]**

Jan 7-21 2019	
57	30 miles (Correct)
43	NET Incorrect/Not sure/No answer
4	25 miles
14	35 miles
9	40 miles
15	Not sure
1	No answer

TOTAL NUMBER CORRECT KNOW1 THROUGH KNOW12:

Jan 7-21 2019	
16	11 out of 11
13	10 out of 11
10	9 out of 11
8	8 out of 11
9	7 out of 11
8	6 out of 11
7	5 out of 11
6	4 out of 11
6	3 out of 11
6	2 out of 11
5	1 out of 11
5	0 out of 11
39	High (9-11 correct)
32	Medium (5-8 correct)
29	Low (0-4 correct)

Previous Pew Research Center surveys with questions on science knowledge can be found in "The Politics of Climate" and "A Look at What the Public Knows and Does Not Know About Science."

ASK ALL:

KNOW14 Based on what you have heard or read, which of the following statements best describes the scientific method? **[RANDOMIZE OPTIONS 1-2]**[14]

Jan 7-21 2019	
67	The scientific method produces findings meant to be continually tested and updated over time
15	The scientific method identifies unchanging core principles and truths
17	Not sure
1	No answer

[14] Note that this question is not included in the science knowledge scale.