Ark Pioneer learning at Home
Core Curriculum
Science

Work to be completed
- Day 1- Variables and apparatus questions
- Day 2- Variables and data analysis questions
- Day 3- Make predictions and collect your own data
- Day 4- Analyse your own data
- Optional Stretch Activity- linked to the work set on days 3&4
- Day 5- News Article

Resources / links to help with work:

https://www.bbc.co.uk/bitesize/guides/zh94y9q/revision/1
https://www.bbc.co.uk/bitesize/topics/zxjj6sg/articles/z2qqj6f

How will this work be checked?
Each week you will be given 'red pen work' to carry out corrections on the learning that you are doing at home. Please make sure this work is done and that you correct all work in your exercise book.
You must also complete the weekly quiz for your core curriculum subjects online and the link to those is on our school website in the 'quizzes' drop-down option from 'Home Learning'.

How much time should I be studying and what happens if I don't finish all my work?
For core curriculum subjects you are expected to do 30min each day as a minimum. Those subjects are English language, English literature, Maths, Science, History and Geography. These subjects all have a weekly quiz and will be checked in on by your form teacher when they call each week.
All other subjects are 'Extended Curriculum' and they should be done after you have finished the Core Curriculum tasks for the day. You should plan to do work in different subjects each day. We recommend that pupils do one hour per week in each of the 'extended curriculum' subjects.
We recognise that it is not possible for all pupils to complete all work given the exceptional circumstance. Please speak with your form tutor about the work if it is becoming unmanageable.

Aim high   Have integrity   Be kind   Model determination

This week's science booklet focuses on investigative skills (skills used when doing and analysing experiments) linked to lots of different science topics rather than one specific unit. You will practice identifying variables and analysing different sets of data.

To help you some key words and pieces of apparatus have been included below:

Independent Variable	The factor that you change during an investigation.
Dependent Variable	The factor that you measure in an investigation to get a result.
Control Variables	The factors that are kept the same so that only the independent variable affects the dependent variable (to keep it a fair test).
Trends in data	The relationship between the independent variable and dependent variable- as the independent variable changes what happens to the dependent variable? Eg as **temperature increases** sugar dissolves in water **faster.**
Appropriate apparatus	The piece of equipment which is most suited to the job you want to do. For example, a small 10ml measuring cylinder is more appropriate than a 100ml beaker for measuring out 6ml of water, the most appropriate piece of apparatus will allow you to do the job more accurately.
Conclusion	Describing what the data shows, this could then be linked to any hypothesis or prediction that was made before the experiment started.

Apparatus	Photo	Description and function
Beaker		A glass container with a pouring lip. Used to hold, mix or heat substances.
Balance		Scales used to measure mass.

Measuring cylinder		A cylindrical container used to measure the volume of liquid.
Test tube		A thin, cylindrical container, usually made of glass. Used to hold chemical and biological substances.
Thermometer		A device that measures temperature.
Funnel		A tube that is wide at one end and narrow at the other. Used to move liquids or particles through a narrow opening.
Bunsen burner		A device used to heat things
Timer / stopwatch		Used to measure the duration of an event. Usually hand-held and operated by buttons.

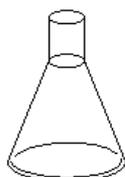https://www.bbc.co.uk/bitesize/guides/zh94y9q/revision/1 is a link to BBC bitesize where they talk about planning science investigations.

Mark Schemes for the questions on days one and two are included at the back of this booklet
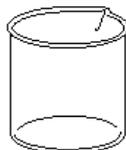
Answer the following questions in your workbook in full sentences.

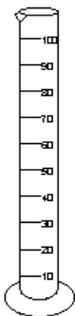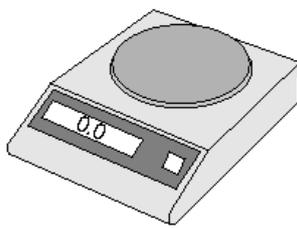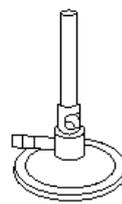**Q1.** The diagram below shows six pieces of equipment.

(a)   Linda investigates **how quickly sugar dissolves in water.**

   (i)   Which piece of equipment should she use to weigh 5 g of sugar?

   (ii)   What is the name of this piece of equipment?

   (iii)   Which piece of equipment should she use to measure out 90 cm^3 of water?

   (iv)   What is the name of this piece of equipment?

(b)   Linda **heats the water in a beaker**.

   (i)   Which piece of equipment shown is a beaker?

   (ii)   Which piece of equipment shown is used to heat water?

   (iii)   What is the name of this piece of equipment?

(c)   Linda adds **5 g of sugar to the hot water**.

   (i)   She measures the time it takes for the sugar to dissolve. The equipment used for timing is **not** shown in the diagram. What piece of equipment is used to measure the time taken?

   (ii)   The equipment used to measure the temperature of the water is **not** shown in the diagram. What piece of equipment is used to measure temperature?

Q2. Two pupils investigated the effect of temperature on how fast oil flows through a funnel. They used the equipment in the photograph below.

(a) They measured the time taken for all the oil to flow through the funnel.

What equipment did they use to measure the time?

(b) Complete the table below to show what they should do with each factor in their investigation. Tick **one** box for each factor.

Factor	Change It	Keep It The Same	Measure It
temperature of the oil			
type of oil			
volume of oil			
time taken for all the oil to flow through the funnel			

(c) (i) Look at their results in the table below.

Temperature of oil (°C)	Time taken for all the oil to flow through the funnel (s)
22	131
40	35
60	22
80	19

What happens to the time taken for the oil to flow through the funnel as its temperature increases?

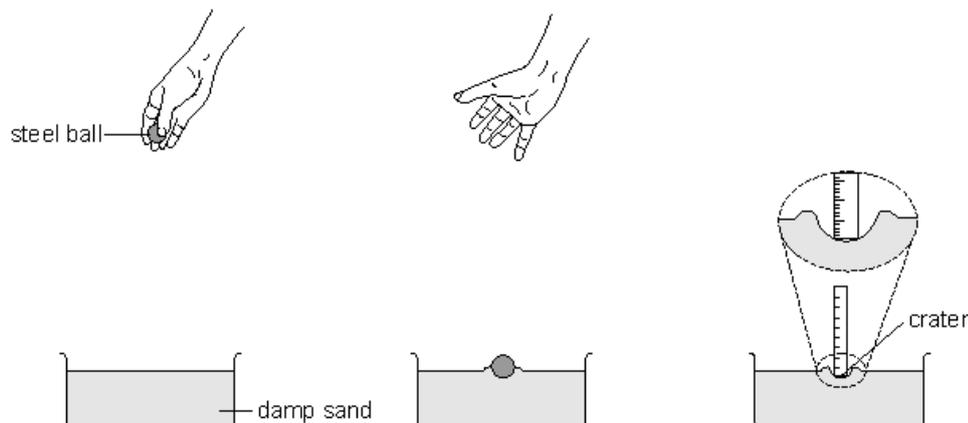(ii) How long would it take for all the oil to flow through the funnel at 15°C?

Choose from the following times. Tick the correct box.

15 seconds ☐

80 seconds ☐

131 seconds ☐

180 seconds ☐

Answer the following questions in your workbook in full sentences.

Q1. Jack and Aneesa dropped a steel ball into trays of damp sand. They measured the depth of the craters made by the steel ball.


not to scale

Their results are shown in the table below.

height the ball was dropped from (cm)	depth of crater (cm)		Aneesa's results
	Jack's results		
10	1.1	1.2	0.8
20	1.4	1.5	1.4
30	1.6	1.6	1.5
40	1.8	1.7	1.8
50	2.0	2.1	2.1

(a)   Use information in the table to answer the questions below.

  (i)   What was the independent variable that Jack and Aneesa changed in their investigation?

  (ii)   Why was Jack's investigation better than Aneesa's?

(b)   Look at the results in the table. What is the relationship between the height the ball was dropped from and the depth of the crater?

(c)   Aneesa said that they made sure the investigation was fair. Suggest **two** variables they must have kept the same to make their investigation fair.

(d)   (i)   Jack removed the steel ball using his fingers. Then he measured the depth of the crater. Aneesa said he should use a magnet instead of his fingers.
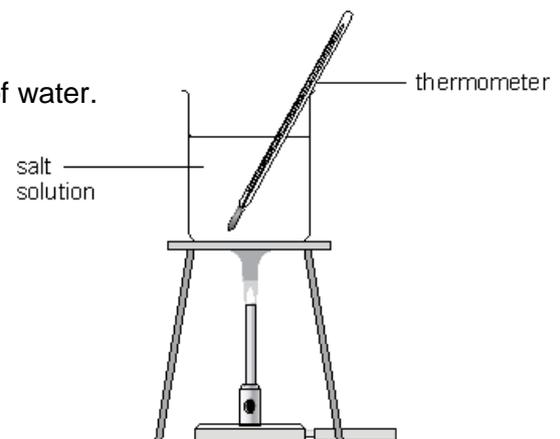
        Explain why using a magnet to remove the ball would improve the investigation.

(ii)   Jack said that the ball could be dropped using an electromagnet instead of dropping it by hand.
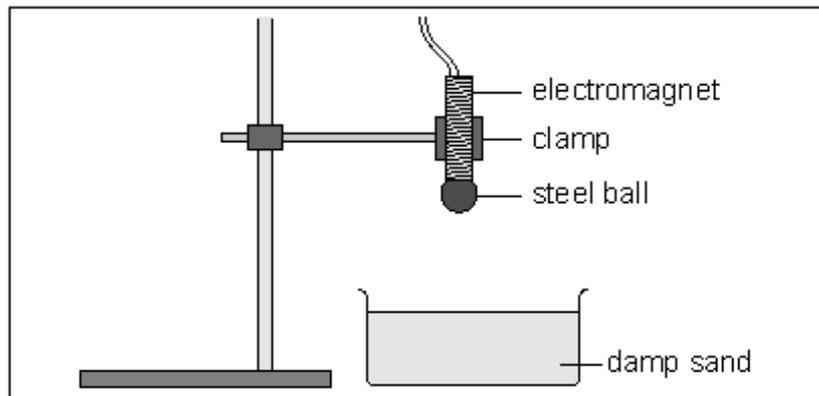
Explain why this would improve the investigation.

Q2. Neera and Tom dissolved different masses of salt in 500 cm³ of water. They measured the temperature at which each salt solution boiled.


(a)   They wrote down the variables that might affect the investigation.

temperature of the laboratory	mass of salt dissolved in water	starting temperature of the water

boiling point of salt solution	volume of water	type of salt used

(i)   What is the independent variable (the variable they changed) in their investigation?

(ii)   What is the dependent variable (the variable they measured) in their investigation?

(iii)   Which variable above would affect the experiment the least?

(b)   Neera and Tom plotted their results and drew the graphs shown below.

Neera's graph

Tom's graph
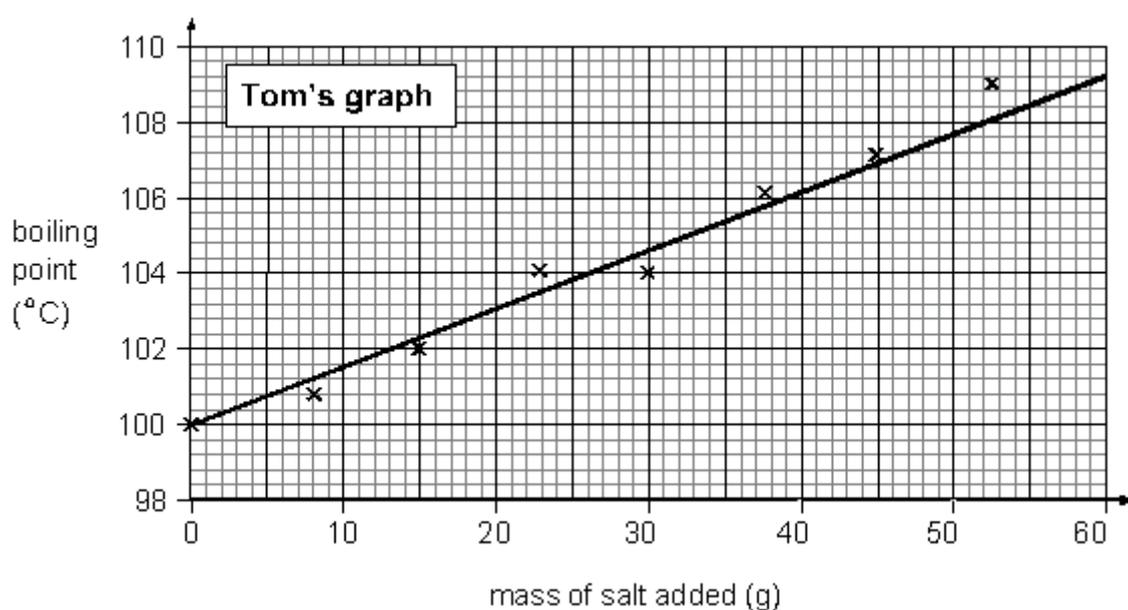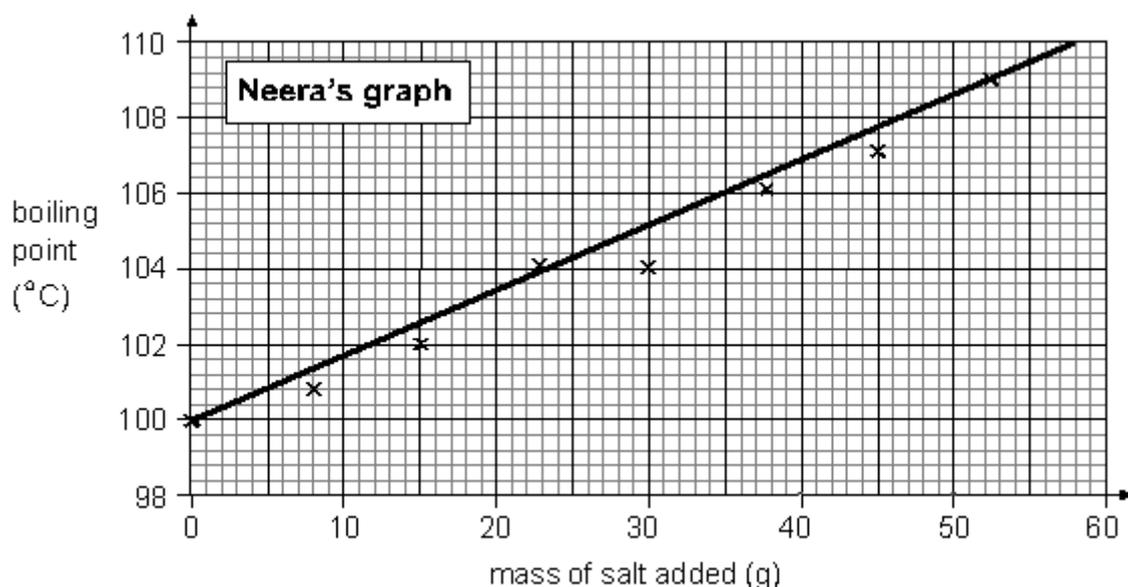
(i)   How can you tell from the graphs that Neera and Tom started with pure water?

(ii)   Why is Tom's line of best fit better than Neera's line of best fit?

Day Three

Make some predictions
Do you think there is any connection between a person's eye colour and their height?
What about a connection between someone's height and their arm span?

Write a prediction for these two questions, after this you will collect the data to test your predictions.

I think that there is / is no connection between eye colour and height…....

I think that the taller someone is…...

Collect some data of your own.

Copy the table below and collect the required data for **at least 5 people (you can include yourself) the more people you collect data from the better**. These can be people that live in your house, friends that can tell you the information over the phone or a combination of both.

You can choose to measure the height and arm span in centimetres (as in the example), metres or feet and inches, just make sure that the unit you use is **consistent for everyone that you measure** (eg if you measure the first person's height in metres you should measure everyone's height in metres).

| Name	Eye Colour	Height	Arm Span
Example *Miss Pick*	*Blue*	*182cm*	*185cm*

Day Four

Analyse your collected data- answer the following questions in your work book in full sentences.

1. Do your results show any link between a person's eye colour and height?

2. Why do you think this is?

3. What is the trend in data linking a person's height and an person's arm span?

4. Why do you think this is?

5. What other factors could you investigate about a person that might be affected by their height?

6. Why is it important that you measured everyone's height and arm span using the same unit each time?

7. What piece of equipment did you use to measure the height and arm span? Do you think this was the appropriate piece of apparatus that could have been used? Why / why not?
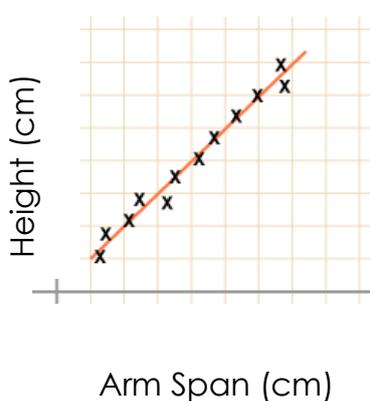
You could draw some graphs to represent your data, I would suggest:

- A **bar graph** to show people's height, arm span or the number of people with each eye colour.
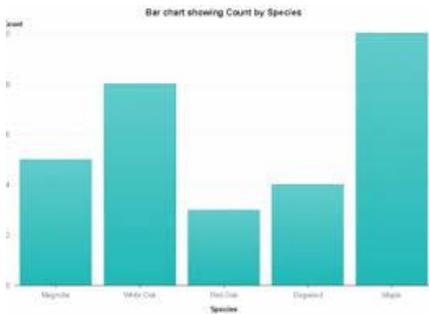
This is what a **bar graph** should look like, remember to label your axis

- A **line graph** to show the relationship between height and arm span.

Line graphs look like this, remember to plot the points with a pencil cross and label your axis with units. You can draw a line of best fit which is one straight line that goes though the majority of the points to show the trend of the data.

Height (cm)

Arm Span (cm)
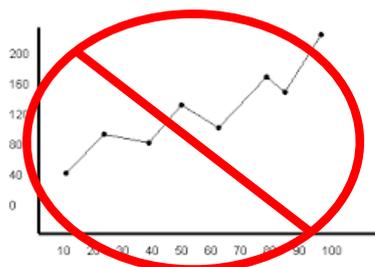
DO NOT CONNECT ALL YOUR POINTS!

Day Five

Read the news article below, you can write down any thoughts you have on the topic of the news article in your book.

Key Words Used in the Article:

amphibians: A group of animals that includes frogs, salamanders and caecilians. Amphibians have backbones and can breathe through their skin. Unlike reptiles, birds and mammals, unborn or unhatched amphibians do not develop in a special protective sac called an amniotic sac.

carcass: The body of a dead animal.

conservation: The act of preserving or protecting something. The focus of this work can range from art objects to endangered species and other aspects of the natural environment.

coyote: This relatively long-legged member of the dog family (*Canis latrans*) is sometimes referred to as the prairie wolf. It is, however, notably smaller and its build more scrawny than a true wolf. Found from Alaska down into Central America, coyotes have lately expanded their range into all 50 U.S. states. Many now hang out in urban areas where they have no predators and can easily dine on rodents and scavenge trashed food.

ecology: A branch of biology that deals with the relations of organisms to one another and to their physical surroundings. A scientist who works in this field is called an **ecologist**.

frequency: The number of times some periodic phenomenon occurs within a specified time interval. (In physics) The number of wavelengths that occurs over a particular interval of time.

herpetologist: The biology of reptiles and amphibians. Scientists who work in this field are known as **herpetologists**.

hibernation: A state of inactivity that some animals enter to save energy at certain times of year. Bears and bats, for example, may hibernate through the winter. During this time, the animal does not move very much, and the use of energy by its body slows down. This eliminates the need to feed for months at a time.

log: (in research) The process of recording data for use or analysis later. For instance, scientists tend to log all of the conditions of their experiments into lab notebooks. That way they can compare the findings from one test with all others — or what conditions they need to faithfully copy if they need to rerun a test.

migration: (v. migrate) Movement from one region or habitat to another, especially regularly (and according to the seasons) or to cope with some driving force (such as climate or war). An individual that makes this move is known as a migrant.

organism: Any living thing, from elephants and plants to bacteria and other types of single-celled life.

ornithology: The scientific study of birds. Experts who work in this field are known as **ornithologists**.

population: (in biology) A group of individuals from the same species that lives in the same area.

predator: (adjective: predatory) A creature that preys on other animals for most or all of its food.

reptile: Cold-blooded vertebrate animals, whose skin is covered with scales or horny plates. Snakes, turtles, lizards and alligators are all reptiles.

rodent: A mammal of the order Rodentia, a group that includes mice, rats, squirrels, guinea pigs, hamsters and porcupines.

species: A group of similar organisms capable of producing offspring that can survive and reproduce.

spider: A type of arthropod with four pairs of legs that usually spin threads of silk that they can use to create webs or other structures.

tone: (in acoustics) The pitch of a sound, especially for musical notes. (in psychology) Changes in a voice that express a particular feeling or mood.

Why you're spotting more wildlife during COVID-19

There aren't more animals, we're just paying better attention to them

Coyotes often live in or near urban areas. Usually, they avoid people by going out at night. But because COVID-19 is keeping people indoors, coyotes are more often roaming by day.

By **Bethany Brookshire**

June 8, 2020 at 6:30 am

As people have spent more time at home during the COVID-19 pandemic, this spring, it seems like wildlife have responded by coming out to play. There are videos of coyotes walking down San Francisco streets. Birdsong seems much louder than before. People are sharing pictures of snakes on sidewalks and bike trails.

And of course, there are the rats. City dwellers are seeing rats everywhere. Because rats can spread disease, the U.S. Centers for Disease Control and Prevention — an agency that works to prevent disease — has offered tips for dealing with the unwelcome rodent tide.

With all the news, it's easy to think that nature is sweeping in and taking over. But it isn't likely that there are more rats or coyotes than normal. The animals aren't even going new places. Instead, COVID-19 has changed the way people behave, and the way we interact with the natural world.

Here are five reasons that people might be running into more wildlife than before.

1. Human handouts are scarce

Urban rats have tended to dine on human trash. With many restaurants closed, the dumpsters they usually fill with trash may now be empty. Hungry rodents now might be forced into the open in search of meals. People have certainly claimed to see more rats. But there are not yet real data to back that up, says Jonathan Richardson. He's an urban ecologist, someone who studies how city organisms interact with each other and their surroundings. He works at the University of Richmond in Virginia.

"We would expect [rats] to be impacted as restaurants close," he says. It does make sense. "But lots of people are throwing that around without data to support it," he says. Richardson and his colleagues are now stepping in to gather such data. To find out where rats are going during COVID-19, they are using surveys by pest management groups and calls to city services about rats.

Rodents populations go through booms and busts. When food is plentiful, rat populations go up. When food disappears, or pest control comes, rat populations fall. If food is scarce enough for rats during shutdowns, Richardson says, "it could be the beginning of a bust cycle. A lot of city health folks are hoping that's the case."

But if there is a bust, he adds, don't expect it to last. "It would absolutely be temporary," he says. "They're just so adapted to breeding quickly and reproducing." Rat packs will rebound quickly.

2. Scary humans aren't around as much

All animals need to avoid predators as they find food and shelter. That creates a landscape of fear — where some places are safer than others, explains John Laundre. He's an ecologist at Western Oregon University in Monmouth.

And the top predator? People. "We are predators on pretty much everything," says Laundre. "Everything fears us."

Black bears avoid areas with lots of people during the day. But when the pandemic hit, it kept people off even the roads — and the bears came out.

For example, live in the Santa Cruz Mountains of California. People do, too. The big cats may chow down peacefully on a carcass if a loudspeaker nearby is playing nature noises. But the big cats run for it when the speaker switches to the sound of people talking. That's the finding of a 2017 study in the journal *Proceedings of the Royal Society B*.

And pumas aren't alone. Black bears living on the edges of towns avoid residential areas by day. They may tend to head out at night, when people are less likely to be around. Those are the results of a 2019 study in the journal *Movement Ecology*.

All that changed during COVID-19. People began staying home in record numbers. And the landscape of fear that we make stayed at home with us. Coyotes live in suburbs and cities, but we rarely see them. To avoid people, they normally restrict their activities to dark. But now they've been sauntering more boldly. "The fewer people they see around," Laundre explains, "the more willing they are to come out during the day."

3. It's nice and quiet

Not all animals fear us. "We can see a lot of birds flying around and coming to our feeders," Laundre notes. Humans pose little threat to them. But people have been taking greater notice of local birds in the time of COVID-19.

"I would say noise pollution is the biggest reason people notice them," says Gustavo Bravo. He's an ornithologist, or someone who studies birds, at Harvard University in Cambridge, Mass.

Noise pollution is a harmful or annoying level of sound. Animals are sensitive to the sounds of traffic and other human activities. Even when they don't fear our noise, it does change their behaviors. "Birds will adjust their song and the times they are singing to account for urban noise," notes Deja Perkins. She's an urban ecologist at North Carolina State University in Raleigh. "Usually they sing earlier in the day to avoid competing with city noises such as traffic." They also sing at a higher sound frequency in urban neighborhoods to help their songs stand out against a city's roar.

But when people went inside because of the pandemic, noise pollution fell. "If everyone is hunkered down at their homes, cities are quieter," Bravo explains. Sounds of the City is a New

York University study of urban noise. It's placed microphones around New York City. And these have picked up less sound from traffic and people as COVID-19 took hold.

It's too early to say if birds have changed their singing times or tones yet, Perkins says. But because streets are quieter, people can hear birds better. And they're paying attention. The Cornell Lab of Ornithology has a Global Big Day every year, which invites people to log their bird observations on the eBird app and website. On May 9, this year, the Lab reported a 32 percent increase in participation compared with Big Day 2019.

A red-winged blackbird preens in hopes of catching a partner's attention. COVID-19 hit during peak bird mating season. Birds like this one are now easier to see and hear.

4. Spring has sprung

If birds have seemed especially musical, that's because they are, Bravo explains. COVID-19 hit the Northern Hemisphere at a critical time. "March, April and May are the spring-migration months in the Northern Hemisphere," he notes. "Also, for the resident birds not migrating, it's the time they mate. They sing a lot — they're looking for their partners."

Birds aren't the only animals searching for companions. "This is the time of year – March, April, May — when snakes are coming out of hibernation, to eat, warm up and look for each other to mate," says David Steen. As a herpetologist, he studies reptiles and amphibians. He works for the Florida Fish and Wildlife Conservation Commission in Gainesville. The snake's timing, this year, has nothing to do with COVID-19. "I've been answering people's questions about snakes and identifying snakes for people for a decade or so," he says. "This is my busy season."

5. We're finally paying attention

Those snakes aren't changing. We are. People who might have traveled to look at rare species before have been stuck a bit closer to home. No longer in schools, cars or offices, we're hanging out in their neighborhoods and in local wild areas — and suddenly more likely to notice them, Steen says.

Many people are finally paying attention to their back gardens, says Helen Smith. She's a spider expert in Norfolk, England where she works with the British Arachnological Society. That Society has conducted several surveys that ask people to report spider sightings. "You're living with these really interesting animals," she says. "Make friends with them."

All our screen time lately also helps shine a spotlight on local wildlife sightings, notes Bravo of Harvard. "People have started to post about it on social media. And because everyone was looking at social media, it spread it out fast."

In his home country of Colombia, Bravo says, "even some national celebrities were posting pictures of birds. It's not something they'd do on a daily basis, but they're sitting at home."

Perkins, in Raleigh, has been involved with #BlackBirdersWeek during COVID-19. It's an effort to promote birders of color on Twitter. She hopes that social media and in-person attention will spark interest in local wildlife that extends beyond the pandemic. "I hope that people continue to go outdoors and make these observations and pay attention to the wildlife that we have around us," Perkins says. Indeed, she adds, it's helping us notice "that people aren't the only things that thrive in cities."

Q1.

(a)   (i)   •   E ✓

              Balance

      (iii)   •   D ✓

              Measuring Cylinder

(b)   (i)   •   B ✓

      (ii)   •   F ✓

              Bunsen burner

(c)   (i)   •   stop watch **or** stop clock

              *accept 'watch' **or** 'clock'*

              'timer' is insufficient

      (ii)   •   thermometer

              accept 'temperature sensor'

              'sensor' is insufficient

Q2.

(a)   any **one** from

      •   stopclock

           'clock' is insufficient

      •   stopwatch

           'watch' is insufficient

           accept 'timer'

(b)

factor	change it	keep it the same	measure it
temperature of the oil	✓		
type of oil		✓	
volume of oil		✓	
time taken for all the oil to flow through the funnel			✓

(c)   (i)   any **one** from

           •   it **or** time gets less

               *accept 'the time gets faster' **or** 'it gets faster'*

do **not** accept 'the time gets slower' unless
linked to a decrease in temperature

- it **or** time decreases
  accept 'the oil flows faster'
  accept 'it goes through faster'

(ii)   180 seconds ✓

Q1.

(a)   (i)   •   the height the ball was dropped from
  accept 'height'
  do **not** accept 'depth'
  accept 'height in cm'
  'cm' is insufficient

(ii)   any **one** from

- he repeated it
  accept 'he got more results'
  accept 'he did it twice'
  'it was a fair test' is insufficient

- he could get an average
  accept 'he would notice odd results'

- it was more reliable
  accept 'more accurate'

(b)   •   the greater the height, the deeper the crater
  accept the converse
  accept 'there is a positive correlation (between the variables)'
  accept 'bigger' for 'deeper' only when it refers to the crater size

  a comparative answer is required for the mark
  'when the ball was dropped from a high height, a larger crater formed' is insufficient
  'the bigger, the deeper' is insufficient as 'bigger' is ambiguous

(c)   any **two** from

- (use the same) ball
  *accept 'the size **or** mass **or** weight **or** volume **or** material of the ball'*
  do **not** accept 'density of ball'

- depth of sand
  *accept 'same amount of sand' **or** 'the (same) sand'*

- the conditions of the sand
  *accept 'how damp the sand was' **or** 'the type of sand'*
  accept 'how flat the sand surface is'

'the sand tray' is insufficient

- where **or** how the depth is measured
    accept 'keep the ruler in the same position'
    'use the same ruler' is insufficient

- the way the ball is released
    accept 'release the ball with the same force'
    'same person' is insufficient

(d) (i) • there is less disturbance to the sand
    accept 'he might push the ball further in'
    accept 'your finger could push it further in, but the magnet lifts it'
    'it would be more accurate' is insufficient
    accept 'it lifts the ball out cleanly'
    'it lifts the ball out' is insufficient

(ii)   any **one** from

- less chance of human error
    accept 'the ball would fall the same way each time'
    *do **not** accept 'there is less chance of something going wrong'*

- the electromagnet would drop it cleanly
    accept 'the ball would not be dropped differently'
    'it lands in the same place' is insufficient
    accept 'it drops at the same angle'
    'it is easier to adjust height' is insufficient
    accept 'the ball would be released from the same height each time'

- the height would be more accurate
    'it is more accurate' is insufficient
    'so it is a fair test' is insufficient
    accept 'they could push the ball (slightly) if they use their hands'
    *do **not** accept 'he can change the force of the electromagnet'*
    'it stays steady' is insufficient

Q2.

(a) (i) • mass of salt dissolved in water
    *accept 'the mass **or** amount of salt'*
    'salt' is insufficient
    *do **not** accept 'the type of salt used'*

(ii) • boiling point of salt solution
    accept 'boiling point'

(iii)   any **one** from

- starting temperature of the water

- temperature of the laboratory

'temperature' is insufficient

(b) (i) • the boiling point with no salt **or** at the start was 100°C

accept 'the water's boiling point was 100°C'
accept 'the boiling point of water is 100°C'
accept 'it boiled at 100°C'
answers must refer to the boiling point
'0 g of salt added' is insufficient
'the graph starts at 100°C' is insufficient

(ii) any **one** from

• there is only one point above the line in Neera's graph

accept 'most points are below the line in Neera's graph'

• there should be a similar number of points above and below the line

accept 'Tom's goes near more points'
or 'Tom's points are nearer to the line'
accept 'Neera just joined the first and last points'