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Level 6 – 19th June 2023

Groundwater pumping by humans has tilted Earth's axis

FREE online quizzes, mp3 listening and more for this lesson here:
https://breakingnewsenglish.com/2306/230619-earths-axis.html

Contents

Please try Levels 4 and 5 (they are easier).

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THE ARTICLE

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhaps it's only geophysicists who are aware of the importance of underground reservoirs on maintaining Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University has discovered that humans have extracted so much groundwater from under our feet that they have changed the tilt of Earth's axis. This shift has been significant enough to physically relocate the geographic North Pole. The mass of polar ice is drifting by 4.36 centimetres a year. Professor Seo calculated that we extracted more than two trillion tons of groundwater between 1993 and 2010, causing Earth to wobble. Seo added that the pumping of groundwater has caused sea levels to rise by 6.24 millimetres.

Professor Seo explained how groundwater affects Earth's gravity. He said: "Every mass moving around on the surface of the Earth can change the rotation axis." Scientists have only recently discovered how groundwater can change Earth's axis. They previously believed water-driven shifts were caused by melting glaciers and ice caps. Seo and his colleagues were puzzled at how this could cause such a tilt. They concluded that the depletion of underground water was also a factor. Much of the extraction of groundwater is due to irrigation, especially in north-western India and western North America. Another researcher said: "The very way the planet wobbles is impacted by our activities."

Sources: https://www.**nature.com**/articles/d41586-023-01993-z
https://www.**science.org**/content/article/humanity-s-groundwater-pumping-has-altered-earth-s-tilt
https://www.**eurekalert.org**/news-releases/992713

WARM-UPS

1. EARTH: Students walk around the class and talk to other students about Earth. Change partners often and share your findings.

2. CHAT: In pairs / groups, talk about these topics or words from the article. What will the article say about them? What can you say about these words and your life?

geophysicist / underground / reservoir / humans / tilt / North Pole / wobble / sea level
gravity / surface / rotation / axis / glaciers / ice caps / factor / irrigation / the planet

Have a chat about the topics you liked. Change topics and partners frequently.

3. WATER BAN: Students A **strongly** believe we should not be using undersground water; Students B **strongly** believe we should. Change partners again and talk about your conversations.

4. GEOSCIENCES: What do you know about these geosciences? How useful are they? Why? Complete this table with your partner(s). Change partners often and share what you wrote.

	Subject	Usefulness	Why?
Geophysics			
Geography			
Geology			
Geometry			
Geopolitics			
Geobotany			

5. GRAVITY: Spend one minute writing down all of the different words you associate with the word "gravity". Share your words with your partner(s) and talk about them. Together, put the words into different categories.

6. WATER USES: Rank these with your partner. Put the most important at the top. Change partners often and share your rankings.

- Washing dishes
- Watering flowers
- Taking a bath
- Washing the car
- Fountains
- Aquariums
- Watering golf courses
- Water parks

VOCABULARY MATCHING

Paragraph 1

1.	aware	a.	A sloping position or movement.
2.	reservoir	b.	A slight change in position, direction, or tendency.
3.	extracted	c.	Having knowledge or perception of a situation or fact.
4.	tilt	d.	Move or cause to move unsteadily from side to side.
5.	shift	e.	A large natural or artificial lake used as a source of water supply.
6.	calculated	f.	Removed or took out, especially by effort or force.
7.	wobble	g.	Found out the amount or number of something mathematically.

Paragraph 2

8.	gravity	h.	Had a strong effect on someone or something.
9.	mass	i.	The force that attracts a body towards the centre of the earth, or towards any other physical body having mass.
10.	rotation	j.	A large body of matter with no definite shape.
11.	glacier	k.	Reduction in the number or quantity of something.
12.	depletion	l.	A slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains.
13.	irrigation	m.	The action of moving about an axis or centre.
14.	impacted	n.	The supply of water to land or crops to help growth, typically by means of channels.

BEFORE READING / LISTENING

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1. TRUE / FALSE: Read the headline. Guess if a-h below are true (T) or false (F).

1. Everyone knows the importance of underground reservoirs. **T / F**
2. Underground reservoirs affect the balance of Earth. **T / F**
3. The pumping of groundwater is moving the North Pole. **T / F**
4. The pumping of groundwater has made sea levels rise. **T / F**
5. The article says groundwater has no effect on gravity. **T / F**
6. Scientists knew groundwater affected Earth's axis centuries ago. **T / F**
7. Most groundwater pumped out of the ground is for irrigation. **T / F**
8. The article says human activity makes Earth wobble. **T / F**

2. SYNONYM MATCH: (The words in **bold** are from the news article.)

1. aware	a. using up
2. importance	b. taken out
3. discovered	c. turning
4. relocate	d. significance
5. extracted	e. actions
6. affects	f. move
7. rotation	g. conscious
8. puzzled	h. influences
9. depletion	i. confused
10. activities	j. found out

3. PHRASE MATCH: (Sometimes more than one choice is possible.)

1. Perhaps it's only geophysicists	a. Earth's gravity
2. they have changed the tilt	b. of underground water
3. The mass of polar ice	c. sea levels to rise
4. we extracted	d. were puzzled
5. pumping of groundwater has caused	e. is drifting
6. how groundwater affects	f. impacted by our activities
7. caused by melting glaciers	g. more than two trillion tons
8. Seo and his colleagues	h. and ice caps
9. the depletion	i. of Earth's axis
10. The very way the planet wobbles is	j. who are aware

GAP FILL

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhaps it's only geophysicists who are (1) _____ of the importance of underground (2) _____ on maintaining Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University has discovered that humans have (3) _____ so much groundwater from under our feet that they have changed the tilt of Earth's axis. This shift has been (4) _____ enough to physically relocate the geographic North Pole. The mass of (5) _____ ice is drifting by 4.36 centimetres a year. Professor Seo (6) _____ that we extracted more than two trillion tons of groundwater between 1993 and 2010, causing Earth to (7) _____. Seo added that the pumping of groundwater has caused sea levels to (8) _____ by 6.24 millimetres.

significant

reservoirs

rise

polar

extracted

wobble

aware

calculated

Professor Seo explained how groundwater affects Earth's (9) _____. He said: "Every mass moving around on the (10) _____ of the Earth can change the (11) _____ axis." Scientists have only recently discovered how groundwater can change Earth's axis. They (12) _____ believed water-driven shifts were caused by melting glaciers and ice caps. Seo and his (13) _____ were puzzled at how this could cause such a tilt. They concluded that the (14) _____ of underground water was also a factor. Much of the extraction of groundwater is due to (15) _____, especially in north-western India and western North America. Another researcher said: "The very way the planet wobbles is (16) _____ by our activities."

surface

depletion

previously

impacted

gravity

irrigation

rotation

colleagues

LISTENING – Guess the answers. Listen to check.

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1) aware of the importance of underground reservoirs on _____
   a. maintaining Earth's imbalance
   b. maintaining Earth's balances
   c. maintaining Earth's balanced
   d. maintaining Earth's balance
2) extracted so much groundwater from under our feet that they have _____
   a. changed the lilt
   b. changed the tilt
   c. changed the silt
   d. changed the hilt
3) The mass of polar ice is drifting by 4.36 centimetres a year. Professor _____
   a. Seo inculcated that
   b. Seo inoculated that
   c. Seo escalated that
   d. Seo calculated that
4) two trillion tons of groundwater between 1993 and 2010, causing _____
   a. Earth to wobble
   b. Earth to gobble
   c. Earth to hobble
   d. Earth to bobble
5) Seo added that the pumping of groundwater has caused sea _____
   a. levels to arise
   b. levels to rise
   c. levels to raise
   d. levels to risen
6) Professor Seo explained how groundwater _____
   a. affects Earth's depravity
   b. affects Earth's gravity
   c. affects Earth's grab a tea
   d. affects Earth's grey verity
7) Every mass moving around on the surface of the Earth can change _____
   a. the rotation axe is
   b. the rotations axis
   c. the rotating axis
   d. the rotation axis
8) They previously believed water-driven shifts were caused by melting glaciers _____
   a. and nice caps
   b. and nice cups
   c. and ice caps
   d. and dice caps
9) Much of the extraction of groundwater is _____
   a. duty irrigation
   b. due to irrigation
   c. dew to irrigation
   d. duet to irrigation
10) Another researcher said: "The very way the planet _____
   a. wobbles is compacted
   b. wobbles is implanted
   c. wobbles is imploded
   d. wobbles is impacted

LISTENING – Listen and fill in the gaps

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhaps it's only geophysicists who (1) _____ the importance of underground (2) _____ Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University has discovered that humans (3) _____ much groundwater from under our feet that they have changed the tilt of Earth's axis. This shift has been significant (4) _____ relocate the geographic North Pole. The mass of polar ice is drifting by 4.36 centimetres a year. Professor Seo calculated that we extracted more than (5) _____ of groundwater between 1993 and 2010, causing Earth to wobble. Seo added that the pumping of groundwater has (6) _____ to rise by 6.24 millimetres.

Professor Seo explained how groundwater (7) _____. He said: "Every mass moving around on the surface of the Earth can change (8) _____." Scientists have only recently discovered how groundwater can change Earth's axis. They previously believed (9) _____ were caused by melting glaciers and ice caps. Seo and his colleagues were puzzled at how this could cause such a tilt. They concluded that (10) _____ underground water was also a factor. Much of the extraction of groundwater is (11) _____, especially in north-western India and western North America. Another researcher said: "The very way the planet wobbles (12) _____ our activities."

COMPREHENSION QUESTIONS

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1. Who is aware of the importance of underground reservoirs?

2. What did scientists say pumping groundwater has relocated?

3. By how much is the polar ice drifting each year?

4. How much water did we extract between 1993 and 2010?

5. By how much has groundwater increased sea levels?

6. What did Professor Seo say affected Earth's gravity?

7. When did scientists find out how groundwater changes Earth's axis?

8. What did the article say melted besides glaciers?

9. What is the cause of most of the pumping of groundwater?

10. What did a researcher say affects the way the planet wobbles?

MULTIPLE CHOICE - QUIZ

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1) Who is aware of the importance of underground reservoirs?
a) geologists
b) geophysicists
c) geographers
d) geobotanists

2) What did scientists say pumping groundwater has relocated?
a) gravity
b) Earth
c) the ice near Siberia
d) the geographic North Pole

3) By how much is the polar ice drifting each year?
a) 4.36 centimetres
b) 3.46 centimetres
c) 6.34 centimetres
d) 4.63 centimetres

4) How much water did we extract between 1993 and 2010?
a) exactly two trillion tons
b) around two trillion tons
c) more than two trillion tons
d) less than two trillion tons

5) By how much has groundwater increased sea levels?
a) by 2.64 millimetres
b) by 6.24 millimetres
c) by 4.26 millimetres
d) by 6.42 millimetres

6) What did Professor Seo say affected Earth's gravity?
a) groundwater
b) magnets
c) ice
d) geophysicists

7) When did scientists find out how groundwater changes Earth's axis?
a) 1946
b) centuries ago
c) recently
d) two decades ago

8) What did the article say melted besides glaciers?
a) ice caps
b) ice cream
c) permafrost
d) ice sheets

9) What is the cause of most of the pumping of groundwater?
a) irrigation
b) gold courses
c) the fashion industry
d) water parks

10) What did a researcher say affects the way the planet wobbles?
a) water
b) Mars
c) permafrost
d) our activities

ROLE PLAY

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Role A – Watering Flowers

You think watering flowers is the most important use of water. Tell the others three reasons why. Tell them what is wrong with their uses. Also, tell the others which is the least important of these (and why): washing the car, aquariums or water parks.

Role B – Washing the Car

You think washing the car is the most important use of water. Tell the others three reasons why. Tell them what is wrong with their uses. Also, tell the others which is the least important of these (and why): watering flowers, aquariums or water parks.

Role C – Aquariums

You think aquariums is the most important use of water. Tell the others three reasons why. Tell them what is wrong with their uses. Also, tell the others which is the least important of these (and why): washing the car, watering flowers or water parks.

Role D – Water Parks

You think water parks is the most important use of water. Tell the others three reasons why. Tell them what is wrong with their uses. Also, tell the others which is the least important of these (and why): washing the car, aquariums or watering flowers.

AFTER READING / LISTENING

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1. WORD SEARCH: Look in your dictionary / computer to find collocates, other meanings, information, synonyms … for the words 'water' and 'Earth'.

water	**Earth**

- Share your findings with your partners.
- Make questions using the words you found.
- Ask your partner / group your questions.

2. ARTICLE QUESTIONS: Look back at the article and write down some questions you would like to ask the class about the text.

- Share your questions with other classmates / groups.
- Ask your partner / group your questions.

3. GAP FILL: In pairs / groups, compare your answers to this exercise. Check your answers. Talk about the words from the activity. Were they new, interesting, worth learning…?

4. VOCABULARY: Circle any words you do not understand. In groups, pool unknown words and use dictionaries to find their meanings.

5. TEST EACH OTHER: Look at the words below. With your partner, try to recall how they were used in the text:

• aware • feet • significant • drifting • tons • levels	• gravity • rotation • previously • caps • due • way

EARTH SURVEY

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Write five GOOD questions about Earth in the table. Do this in pairs. Each student must write the questions on his / her own paper.
When you have finished, interview other students. Write down their answers.

	STUDENT 1 _____	STUDENT 2 _____	STUDENT 3 _____
Q.1.			
Q.2.			
Q.3.			
Q.4.			
Q.5.			

- Now return to your original partner and share and talk about what you found out. Change partners often.
- Make mini-presentations to other groups on your findings.

EARTH DISCUSSION

STUDENT A's QUESTIONS (Do not show these to student B)

1. What did you think when you read the headline?
2. What images are in your mind when you hear the word 'water'?
3. What do you know about groundwater?
4. What do you know about Earth's balance?
5. What do you know about geophysics?
6. How important is it that Earth tilts at the correct angle?
7. What do you know about the North Pole?
8. What does it matter if the North Pole is drifting?
9. Should we stop using so much groundwater?
10. How can we conserve water?

EARTH DISCUSSION

STUDENT B's QUESTIONS (Do not show these to student A)

11. Did you like reading this article? Why/not?
12. What do you think of when you hear the word 'Earth'?
13. What do you think about what you read?
14. What do you know about gravity?
15. How much do you worry about melting glaciers and ice caps?
16. What can farms do if they do not have enough water?
17. What does it matter if the world wobbles more?
18. What three adjectives best describe this story?
19. What are we doing to impact Earth?
20. What questions would you like to ask the geophysicists?

DISCUSSION (Write your own questions)

STUDENT A's QUESTIONS (Do not show these to student B)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

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DISCUSSION (Write your own questions)

STUDENT B's QUESTIONS (Do not show these to student A)

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

LANGUAGE - CLOZE

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhaps it's only geophysicists who are (1) _____ of the importance of underground reservoirs (2) _____ maintaining Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University has discovered that humans have extracted (3) _____ much groundwater from under our feet that they have changed the tilt of Earth's axis. This shift has been significant (4) _____ to physically relocate the geographic North Pole. The mass of polar ice is drifting by 4.36 centimetres a year. Professor Seo calculated that we (5) _____ more than two trillion tons of groundwater between 1993 and 2010, causing Earth to (6) _____. Seo added that the pumping of groundwater has caused sea levels to rise by 6.24 millimetres.

Professor Seo explained how groundwater affects Earth's gravity. He said: "Every (7) _____ moving around on the surface of the Earth can change the rotation axis." Scientists have only (8) _____ discovered how groundwater can change Earth's axis. They previously believed water-driven shifts were caused by melting glaciers and ice (9) _____. Seo and his colleagues were puzzled at how this could cause such a tilt. They concluded that the depletion (10) _____ underground water was also a factor. Much of the extraction of groundwater is (11) _____ to irrigation, especially in north-western India and western North America. Another researcher said: "The very way the planet wobbles is (12) _____ by our activities."

Put the correct words from the table below in the above article.

1.	(a)	aware	(b)	beware	(c)	wary	(d)	warned
2.	(a)	at	(b)	by	(c)	on	(d)	as
3.	(a)	from	(b)	at	(c)	so	(d)	by
4.	(a)	plenty	(b)	ample	(c)	abundant	(d)	enough
5.	(a)	extracted	(b)	retracted	(c)	detracted	(d)	contracted
6.	(a)	cobble	(b)	wobble	(c)	hobble	(d)	gobble
7.	(a)	moss	(b)	mess	(c)	miss	(d)	mass
8.	(a)	recounted	(b)	recently	(c)	recommended	(d)	recoiled
9.	(a)	limits	(b)	caps	(c)	hats	(d)	peaks
10.	(a)	of	(b)	off	(c)	by	(d)	as
11.	(a)	extracted	(b)	owing	(c)	far	(d)	due
12.	(a)	packed	(b)	impacted	(c)	compacted	(d)	repacked

SPELLING

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Paragraph 1

1. it's only hietpcsygsosi who are aware
2. underground eorrrevssi
3. humans have extadctre so much groundwater
4. significant enough to phslcyaliy relocate
5. Seo ctcleluaad that
6. causing Earth to eowblb

Paragraph 2

7. groundwater affects Earth's igarytv
8. on the acfusre of the Earth
9. change the toiatron axis
10. his cgelseualo were puzzled
11. the itdenelop of underground water
12. due to oniraitgri

PUT THE TEXT BACK TOGETHER

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Number these lines in the correct order.

( ) such a tilt. They concluded that the depletion of underground water was also a

( ) North Pole. The mass of polar ice is drifting by 4.36 centimetres a year. Professor Seo calculated that we extracted

( ) Professor Seo explained how groundwater affects Earth's gravity. He said: "Every mass moving around on the surface

( ) on maintaining Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University has

( ) of the Earth can change the rotation axis." Scientists have only recently discovered how

(***1***) Perhaps it's only geophysicists who are aware of the importance of underground reservoirs

( ) wobble. Seo added that the pumping of groundwater has caused sea levels to rise by 6.24 millimetres.

( ) by melting glaciers and ice caps. Seo and his colleagues were puzzled at how this could cause

( ) groundwater can change Earth's axis. They previously believed water-driven shifts were caused

( ) discovered that humans have extracted so much groundwater from under our feet that they have changed

( ) the tilt of Earth's axis. This shift has been significant enough to physically relocate the geographic

( ) western North America. Another researcher said: "The very way the planet wobbles is impacted by our activities."

( ) factor. Much of the extraction of groundwater is due to irrigation, especially in north-western India and

( ) more than two trillion tons of groundwater between 1993 and 2010, causing Earth to

PUT THE WORDS IN THE RIGHT ORDER

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

1. aware . who Perhaps are it's only geophysicists

2. from feet . so Extracted groundwater under much our

3. the North physically Pole . relocate Significant enough to

4. of ice is polar The drifting . mass

5. groundwater Pumping levels to sea caused of rise .

6. groundwater how Earth's affects gravity . explained He

7. mass around moving on the surface . Every

8. this a Puzzled cause at how could tilt .

9. a underground of factor . was depletion The water

10. The to groundwater is of irrigation . due extraction

CIRCLE THE CORRECT WORD (20 PAIRS)

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhaps it's only geophysicists who are *aware / beware* of the importance of underground reservoirs *on / of* maintaining Earth's balance. Geophysicist Ki-Weon Seo from Seoul National University *has / had* discovered that humans have extracted so much groundwater from under our feet that they have *changed / charged* the tilt of Earth's axis. This *shaft / shift* has been significant enough to physically relocate *a / the* geographic North Pole. The mass of polar ice is *drifting / drafting* by 4.36 centimetres a year. Professor Seo calculated that we *exacted / extracted* more than two trillion tons of groundwater between 1993 and 2010, causing Earth to *cobble / wobble*. Seo added that the pumping of groundwater has caused sea levels to *raise / rise* by 6.24 millimetres.

Professor Seo explained how groundwater *affects / effects* Earth's gravity. He said: "Every *moss / mass* moving around on the surface of the Earth can change the rotation *axle / axis*." Scientists have only recently discovered how groundwater can change Earth's axis. They previously *belief / believed* water-driven shifts were caused by melting glaciers and ice *cups / caps*. Seo and his colleagues were puzzled at *what / how* this could cause such a tilt. They concluded that the *depletion / repletion* of underground water was also a factor. Much of the extraction of groundwater is *due / up* to irrigation, especially *in / at* north-western India and western North America. Another researcher said: "The very way the planet wobbles is impacted *on / by* our activities."

Talk about the connection between each pair of words in italics, and why the correct word is correct. Look up the definition of new words.

INSERT THE VOWELS (a, e, i, o, u)

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

P_rh_ps _t's _nly g__phys_c_sts wh_ _r_ _w_r_ _f th_ _mp_rt_nc_ _f und_rgr_und r_s_rv__rs _n m__nt__n_ng __rth's b_l_nc_. G__phys_c_st K_-W__n S__ fr_m S__ul N_t__n_l Un_v_rs_ty h_s d_sc_v_r_d th_t hum_ns h_v_ _xtr_ct_d s_ much gr_undw_t_r fr_m und_r _ur f__t th_t th_y h_v_ ch_ng_d th_ t_lt _f __rth's _x_s. Th_s sh_ft h_s b__n s_gn_f_c_nt _n_ugh t_ phys_c_lly r_l_c_t_ th_ g__gr_ph_c N_rth P_l_. Th_ m_ss _f p_l_r _c_ _s dr_ft_ng by 4.36 c_nt_m_tr_s _ y__r. Pr_f_ss_r S__ c_lcul_t_d th_t w_ _xtr_ct_d m_r_ th_n tw_ tr_ll__n t_ns _f gr_undw_t_r b_tw__n 1993 _nd 2010, c_us_ng __rth t_ w_bbl_. S__ _dd_d th_t th_ pump_ng _f gr_undw_t_r h_s c_us_d s__ l_v_ls t_ r_s_ by 6.24 m_ll_m_tr_s.

Pr_f_ss_r S__ _xpl__n_d h_w gr_undw_t_r _ff_cts __rth's gr_v_ty. H_ s__d: "_v_ry m_ss m_v_ng _r_und _n th_ surf_c_ _f th_ __rth c_n ch_ng_ th_ r_t_t__n _x_s." Sc__nt_sts h_v_ _nly r_c_ntly d_sc_v_r_d h_w gr_undw_t_r c_n ch_ng_ __rth's _x_s. Th_y pr_v__usly b_l__v_d w_t_r-dr_v_n sh_fts w_r_ c_us_d by m_lt_ng gl_c__rs _nd _c_ c_ps. S__ _nd h_s c_ll__gu_s w_r_ puzzl_d _t h_w th_s c_uld c_us_ such _ t_lt. Th_y c_nclud_d th_t th_ d_pl_t__n _f und_rgr_und w_t_r w_s _ls_ _ f_ct_r. Much _f th_ _xtr_ct__n _f gr_undw_t_r _s du_ t_ _rr_g_t__n, _sp_c__lly _n n_rth-w_st_rn _nd__ _nd w_st_rn N_rth _m_r_c_. _n_th_r r_s__rch_r s__d: "Th_ v_ry w_y th_ pl_n_t w_bbl_s _s _mp_ct_d by _ur _ct_v_t__s."

PUNCTUATE THE TEXT AND ADD CAPITALS

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

perhaps its only geophysicists who are aware of the importance of underground reservoirs on maintaining earths balance geophysicist kiweon seo from seoul national university has discovered that humans have extracted so much groundwater from under our feet that they have changed the tilt of earths axis this shift has been significant enough to physically relocate the geographic north pole the mass of polar ice is drifting by 436 centimetres a year professor seo calculated that we extracted more than two trillion tons of groundwater between 1993 and 2010 causing earth to wobble seo added that the pumping of groundwater has caused sea levels to rise by 624 millimetres

professor seo explained how groundwater affects earths gravity he said every mass moving around on the surface of the earth can change the rotation axis scientists have only recently discovered how groundwater can change earths axis they previously believed waterdriven shifts were caused by melting glaciers and ice caps seo and his colleagues were puzzled at how this could cause such a tilt they concluded that the depletion of underground water was also a factor much of the extraction of groundwater is due to irrigation especially in northwestern india and western north america another researcher said the very way the planet wobbles is impacted by our activities

PUT A SLASH (/) WHERE THE SPACES ARE

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Perhapsit'sonlygeophysicistswhoareawareoftheimportanceofunder groundreservoirsonmaintainingEarth'sbalance.GeophysicistKi-We onSeofromSeoulNationalUniversityhasdiscoveredthathumanshave extractedsomuchgroundwaterfromunderourfeetthattheyhavechan gedthetiltofEarth'saxis.Thisshifthasbeensignificantenoughtophysic allyrelocatethegeographicNorthPole.Themassofpolariceisdriftingby 4.36centimetresayear.ProfessorSeocalculatedthatweextractedmor ethantwotrilliontonsofgroundwaterbetween1993and2010,causing arthtowobble.Seoaddedthatthepumpingofgroundwaterhascauseds ealevelstoriseby6.24millimetres.ProfessorSeoexplainedhowground wateraffectsEarth'sgravity.Hesaid:"Everymassmovingaroundonthe surfaceoftheEarthcanchangetherotationaxis."Scientistshaveonlyre centlydiscoveredhowgroundwatercanchangeEarth'saxis.Theyprevi ouslybelievedwater-drivenshiftswerecausedbymeltingglaciersandic ecaps.Seoandhiscolleagueswerepuzzledathowthiscouldcausesucha tilt.Theyconcludedthatthedepletionofundergroundwaterwasalsoafa ctor.Muchoftheextractionofgroundwaterisduetoirrigation,especially innorth-westernIndiaandwesternNorthAmerica.Anotherresearc hersaid:"Theverywaytheplanetwobblesisimpactedbyouractivities."

FREE WRITING

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

Write about **Earth** for 10 minutes. Comment on your partner's paper.

ACADEMIC WRITING

From https://breakingnewsenglish.com/2306/230619-earths-axis.html

There should be limits on the amount of water we use. Discuss.

HOMEWORK

1. VOCABULARY EXTENSION: Choose several of the words from the text. Use a dictionary or Google's search field (or another search engine) to build up more associations / collocations of each word.

2. INTERNET: Search the Internet and find out more about this news story. Share what you discover with your partner(s) in the next lesson.

3. EARTH: Make a poster about Earth. Show your work to your classmates in the next lesson. Did you all have similar things?

4. WATER LIMITS: Write a magazine article about making legal water limits on how much water we use.. Include imaginary interviews with people who are for and against this.

Read what you wrote to your classmates in the next lesson. Write down any new words and expressions you hear from your partner(s).

5. WHAT HAPPENED NEXT? Write a newspaper article about the next stage in this news story. Read what you wrote to your classmates in the next lesson. Give each other feedback on your articles.

6. LETTER: Write a letter to an expert on Earth. Ask him/her three questions about it. Give him/her three of your ideas on how to save it. Read your letter to your partner(s) in your next lesson. Your partner(s) will answer your questions.

ANSWERS

VOCABULARY (p.4)

1.	c	2.	e	3.	f	4.	a	5.	b	6.	g	7.	d
8.	i	9.	j	10.	m	11.	l	12.	k	13.	n	14.	h

TRUE / FALSE (p.5)

1	F	2	T	3	T	4	T	5	F	6	F	7	T	8	T

SYNONYM MATCH (p.5)

1. g	2. d	3. j	4. f	5. b
6. h	7. c	8. i	9. a	10. e

COMPREHENSION QUESTIONS (p.9)

1. Geophysicists
2. The geographic North Pole
3. 4.36 centimetres
4. More than two trillion tons
5. By 6.24 millimetres
6. Groundwater
7. Recently
8. Ice caps
9. Irrigation
10. Our activities

WORDS IN THE RIGHT ORDER (p.19)

1. Perhaps it's only geophysicists who are aware.
2. Extracted so much groundwater from under our feet.
3. Significant enough to physically relocate the North Pole.
4. The mass of polar ice is drifting.
5. Pumping of groundwater caused sea levels to rise.
6. He explained how groundwater affects Earth's gravity.
7. Every mass moving around on the surface.
8. Puzzled at how this could cause a tilt.
9. The depletion of underground water was a factor.
10. The extraction of groundwater is due to irrigation.

MULTIPLE CHOICE - QUIZ (p.10)

1.	b	2.	d	3.	a	4.	c	5.	b	6.	a	7.	c	8.	a	9.	a	10.	d

ALL OTHER EXERCISES

Please check for yourself by looking at the Article on page 2.
(It's good for your English ;-)