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day 162 computers and networks

Chinese HSK 7–9 in 193 days
unit 22 · science and technology

Talk about computers, servers, networks and security in Chinese, use the advanced set verbs (巴不得, 恨不得, 并非, 免不了, 所谓, 可谓, 犯不着, 可否, 除外, 予以, 有所), and sum up with 概括来说.

Tech vocabulary is everywhere in Chinese life, from your phone's settings to the news. And the set verbs of this level (并非, 免不了, 所谓) are what make Chinese sound grown-up, in speech and in writing.

words

word	pinyin	meaning	example
编程	biānchéng	programming; to program	她十二岁就开始学编程了。 She started learning to code at twelve.
服务器	fúwùqì	server	公司的服务器昨天晚上出了问题。 The company's server went wrong last night.
数据库	shùjùkù	database	所有客户的信息都存|在数据库里。 All the customers' details are kept in the database.
大数据	dàshùjù	big data	很多公司用大数据来了解用户。 Many companies use big data to understand their users.
内存	nèicún	memory (RAM)	这台手机的内存不够了。 This phone has run out of memory.
硬盘	yìngpán	hard disk	照片都存|在移动硬盘里。 The photos are all on an external hard drive.
芯片	xīnpiàn	(micro)chip	这款台灯里有一块小芯片。 There's a small chip inside this lamp.
显示器	xiǎnshìqì	monitor, display	我买了一台更大的显示器。 I bought a bigger monitor.
液晶	yèjīng	liquid crystal (LCD)	现在的电视大多是液晶电视。 Most TVs today are LCD TVs.
光盘	guāngpán	CD, disc	现在很少有人用光盘听音乐了。 Hardly anyone listens to music on CD any more.
磁带	cídài	(cassette) tape	我小时候用磁带学外语。 As a child I learned foreign languages from cassettes.
主页	zhǔyè	homepage	请打开学校网站的主页。 Please open the homepage of the school website.
黑客	hēikè	hacker	黑客攻击了这家银行的网站。 Hackers attacked the bank's website.
防火墙	fánghuǒqiáng	firewall	公司的电脑都装了防火墙。 All the company's computers have a firewall.
杀毒	shādú	kill viruses, scan for viruses	电脑要定期杀毒。 Computers should be scanned for viruses regularly.

备份	bèifèn	back up; backup	重要的文件一定要备份。 Always back up important files.
卸载	xièzài	uninstall; unload	不用的软件可以卸载。 You can uninstall software you don't use.
激活	jīhuó	activate	新手机要先激活才能用。 A new phone has to be activated before you can use it.
调试	tiáoshì	debug, fine-tune	工程师正在调试新系统。 The engineers are testing and tuning the new system.
兼容	jiānróng	compatible	这个软件跟旧电脑不兼容。 This software isn't compatible with old computers.
交互	jiāohù	interactive; interact	这个网站的交互设计很好。 This website's interaction design is very good.
虚拟	xūnǐ	virtual	戴上这副眼镜，你就进入了一个虚拟的世界。 Put on these glasses and you enter a virtual world.
仿真	fǎngzhēn	simulate; simulation	飞行员先在仿真的环境里练习。 Pilots first practise in a simulated environment.
三维	sānwéi	three-dimensional, 3D	这部电影是三维的。 This film is in 3D.
数码	shùmǎ	digital	他喜欢买各种数码产品。 He loves buying all kinds of digital gadgets.
无线	wúxiàn	wireless	这家咖啡店有免费的无线网络。 This café has free Wi-Fi.
光缆	guānglǎn	optical (fibre) cable	有了新的光缆，上网快了很多。 With the new fibre cable, the internet is much faster.
电信	diànxìn	telecommunications	他在一家电信公司工作。 He works for a telecoms company.
天线	tiānxiàn	antenna, aerial	楼顶上装着一根大天线。 There's a big aerial on the roof.
终端	zhōngduān	terminal (device)	手机已经成了最重要的上网终端。 The phone has become the main device for going online.
遥控	yáokòng	remote control	这台空调可以用手机遥控。 You can control this air conditioner from your phone.
切换	qiēhuàn	switch (between)	按这个键，就可以切换语言。 Press this key to switch languages.
屏蔽	píngbì	block, shield	我把这个人的消息屏蔽了。 I've blocked this person's messages.
同步	tóngbù	synchronise; in sync	手机和电脑上的文件会自动同步。 Files on your phone and computer sync automatically.
设定	shèdìng	set, set up	我把闹钟设定在早上六点。 I set the alarm for six in the morning.

pattern set verbs: 巴不得, 恨不得, 并非, 免不了, 所谓, 可谓, 犯不着, 可否, 除外, 予以, 有所

subject | **巴不得 / 恨不得 / 免不了 / 犯不着 …** | **+ what follows**

These fixed verbs each carry a whole idea: 巴不得 / 恨不得 “be dying to”, 并非 “is not (in fact)”, 免不了 “can’t avoid”, 所谓 “so-called”, 可谓 “can truly be called”, 犯不着 “it’s not worth”, 可否 “could … ? (formal)”, X除外 “except X”, 予以 “give (formal: 予以补偿)”, 有所 “to some extent (有所提高)”. And back from day 156: 概括来说 to sum it all up.

防火墙并非什么都能挡住。所谓“安全”，只是相对的。 **fánghuǒqiáng bìngfēi shénme dōu néng dǎng zhù suǒwèi ānquán zhǐshì xiāngduì de** A firewall can’t stop everything. So-called “security” is only relative.

犯不着为这点事着急，可是要认真对待。 **fànbuzháo wèi zhè diǎn shì zháojí kěshì yào rènzhēn duìdài** It’s not worth panicking over, but it has to be taken seriously.

这次的损失，我们会对客户予以补偿。 **zhè cì de sǔnshī wǒmen huì duì kèhù yǔyǐ bǔcháng** We will compensate our customers for this loss.

所有电脑都要检查，前台那两台除外。 **suǒyǒu diànnǎo dōu yào jiǎnchá qiántái nà liǎng tái chúwài** Every computer has to be checked, except the two at reception.

dialogue the server goes down

anna 小明，快来帮忙！订单系统从早上就打不开了，客户都在问。我恨不得马上把它修好。

Xiǎomíng kuài lái bāngmáng dìngdān xìtǒng cóng zǎoshang jiù dǎ bu kāi le kèhù dōu zài wèn wǒ hènbude mǎshàng bǎ tā xiū hǎo · Xiaoming, help! The order system has been down since this morning, and the customers are all asking. I'm dying to get it fixed now.

xiaoming 别急，我看看……服务器的内存快用完了，硬盘也满了。访问量急剧增加，有人在攻击你们的网站，应该是黑客。

bié jí wǒ kàn kan fúwùqì de nèicún kuài yòng wán le yìngpán yě mǎn le fǎngwèn liàng jíjù zēngjiā yǒu rén zài gōngjī nǐmen de wǎngzhàn yīnggāi shì hēikè · Don't panic, let me look … The server's memory is nearly used up and the hard disk is full. The traffic has shot up: someone is attacking your website, probably hackers.

manager liu 黑客？我们装了防火墙啊。

hēikè wǒmen zhuāng le fánghuǒqiáng a · Hackers? But we have a firewall.

xiaoming 防火墙并非什么都能挡住。所谓“安全”，只是相对的。你们的系统好几年没有更新了，免不了有漏洞。

fánghuǒqiáng bìngfēi shénme dōu néng dǎng zhù suǒwèi ānquán zhǐshì xiāngduì de nǐmen de xìtǒng hǎo jǐ nián méiyǒu gēngxīn le miǎnbuliǎo yǒu lòudòng · A firewall can't stop everything. So-called "security" is only relative. Your system hasn't been updated for years, so it's bound to have holes.

manager liu 这方面我是外行。你是内行，你看怎么处置吧。

zhè fāngmiàn wǒ shì wàiháng nǐ shì nèiháng nǐ kàn zěnme chǔzhì ba · I'm no expert on this. You are: you decide how to handle it.

anna 那数据库里客户的信息呢？会不会丢？

nà shùjùkù lǐ kèhù de xìnxī ne huì bu huì diū · What about the customer details in the database? Could we lose them?

xiaoming 别担心，你们每天晚上都备份。我先把系统切换到备用的服务器上，再杀毒，把不用的软件都卸载了。

bié dānxīn nǐmen měi tiān wǎnshang dōu bèifèn wǒ xiān bǎ xìtǒng qiēhuàn dào bèiyòng de fúwùqì shàng zài shādú bǎ búyòng de ruǎnjiàn dōu xièzài le · Don't worry, you back up every night. First I'll switch the system over to the spare server, then scan for viruses and uninstall the software you don't use.

manager liu 犯不着为这点事这么着急吧？

fànbuzháo wèi zhè diǎn shì zhème zháojí ba · Surely it's not worth getting this worked up about?

xiaoming 犯不着着急，可是要认真对待。我还要调试一下新系统，看看它跟你们的旧终端兼容不兼容。

fànbuzháo zháojí kěshì yào rènzhēn duìdài wǒ hái yào tiáoshì yíxià xīn xìtǒng kàn kan tā gēn nǐmen de jiù zhōngduān jiānróng bù jiānróng · Not worth panicking, but worth taking seriously. I also need to test and tune the new system and see whether it works with your old terminals.

anna 我们的台灯也连着网络：用户可以用手机遥控，设定开灯的时间，数据会自动同步到手机上。台灯里的芯片会不会也有危险？

wǒmen de táidēng yě lián zhe wǎngluò yònghù kěyǐ yòng shǒujī yáokòng shèdìng kāi dēng de shíjiān shùjù huì zìdòng tóngbù dào shǒujī shàng táidēng lǐ de xīnpiàn huì bu huì yě yǒu wēixiǎn · Our lamps are online too: users control them from their phones and set the times they switch on, and the data syncs to the phone automatically. Could the chips in the lamps be at risk too?

xiaoming 台灯用的是无线网络，我会一个一个检查。另外，你们主页上那个三维的虚拟台灯做得很好，交互也不错，可是服务器承载不了这么大的压力。

táidēng yòng de shì wúxiàn wǎngluò wǒ huì yí gè yí gè jiǎnchá lìngwài nǐmen zhǔyè shàng nàge sānwéi de xūnǐ táidēng zuò de hěn hǎo jiāohù yě búcuò kěshì fúwùqì chéngzài bu liǎo zhème dà de yālì · The lamps use wireless; I'll check them one by one. And that 3D virtual lamp on your homepage is very nicely done, and the interaction is good, but the server can't carry that kind of load.

manager liu 其他产品可否也检查一下？所有电脑都要检查，前台那两台旧电脑除外，它们没有联网。

qítā chǎnpǐn kěfǒu yě jiǎnchá yíxià suǒyǒu diànnǎo dōu yào jiǎnchá qiántái nà liǎng tái jiù diànnǎo chúwài tāmen méiyǒu liánwǎng · Could you check our other products as well? And every computer needs checking, except the two old ones at reception: they're not online.

xiaoming 没问题。不过，你们的显示器还是老的液晶的，性能也差，该换一批新的数码设备了。

méi wèntí búguò nǐmen de xiǎnshìqì háishi lǎo de yèjīng de xìngnéng yě chà gāi huàn yì pī xīn de shùmǎ shèbèi le · No problem. But your monitors are old LCD ones and the performance is poor: it's time for a batch of new digital kit.

manager liu 我巴不得都换了呢，可是预算有限。这次的损失，我们会对客户予以补偿。

wǒ bābudé dōu huàn le ne kěshì yùsuàn yǒuxiàn zhè cì de sǔnshī wǒmen huì duì kèhù yǔyǐ bǔcháng · I'd love to replace the lot, but the budget is limited. We'll compensate our customers for this loss.

xiaoming 旧电脑太耗电，换了也能省钱。那个新来的同事刚学编程，是个新手吧？听说他很有天分。我看见他桌子上有光盘，还有几盘磁带。

jiù diànnǎo tài hào diàn huàn le yě néng shěng qián nàge xīn lái de tóngshì gāng xué biānchéng shì gè xīnshǒu ba tīngshuō tā hěn yǒu tiānfèn wǒ kànjiàn tā zhuōzi shàng yǒu guāngpán hái yǒu jǐ pán cídài · Old computers eat electricity, so replacing them saves money too. That new colleague has only just started coding, hasn't he? I hear he has a real gift for it. I saw CDs on his desk, and a few cassette tapes.

anna 哈哈，那是刘经理的“古董”。现在是大数据时代，可是她说扔了可惜。

hā hā nà shì Liújīnglǐ de gǔdǒng xiànzài shì dàshùjù shídài kěshì tā shuō rēng le kěxī · Ha ha, those are Manager Liu's "antiques". This is the age of big data, but she says it would be a shame to throw them out.

xiaoming 好了，服务器恢复了。新系统我已经帮你们激活了，也在仿真的环境里测试过了。攻击你们的那个地址，我也屏蔽了。以后你们要定期排查漏洞。

hǎo le fúwùqì huīfù le xīn xìtǒng wǒ yǐjīng bāng nǐmen jīhuó le yě zài fǎngzhēn de huánjìng lǐ cèshì guo le gōngjī nǐmen de nàge dìzhǐ wǒ yě píngbì le yǐhòu nǐmen yào dìngqī páichá lòudòng · There: the server is back up. I've activated the new system for you and tested it in a simulated environment. I've also blocked the address that was attacking you. From now on you should check for holes regularly.

anna 太感谢了！你修电脑真有两下子。概括来说，这次的问题可谓不大不小：系统旧，内存小，黑客正好找到了机会。

tài gǎnxiè le nǐ xiū diànnǎo zhēn yǒu liǎngxiàzi gàikuò lái shuō zhè cì de wèntí kěwèi bú dà bù xiǎo xìtǒng jiù nèicún xiǎo hēikè zhènghǎo zhǎo dào le jīhuì · Thank you so much! You really know your way around a computer. To sum up, this problem was neither big nor small: an old system, too little memory, and the hackers saw their chance.

manager liu 小明是电脑方面的行家，技术真过硬。

Xiǎomíng shì diànnǎo fāngmiàn de hángjia jìshù zhēn guòyìng · Xiaoming is a real computer expert: his skills are first-rate.

xiaoming 过奖了。我建议你们找电信公司把光缆升级一下，楼顶上的天线也该换了。这样，网络会更通畅，速度和安全都会有所提高。

guòjiǎng le wǒ jiànyì nǐmen zhǎo diànxìn gōngsī bǎ guānglǎn shēngjí yíxià lóu dǐng shàng de tiānxiàn yě gāi huàn le zhèyàng wǎngluò huì gèng tōngchàng sùdù hé ānquán dōu huì yǒusuǒ tígāo · You flatter me. I suggest you get the telecoms company to upgrade your fibre cable, and the aerial on the roof should be replaced too. Then the network will run more smoothly, and both speed and security will improve somewhat.

write it trace the grey, then write your own

芯
xīn
core

磁 cí magnetic													

good to know · 巴不得 and 恨不得 both mean “be dying to”; 恨不得 is stronger and often for something you can’t really do: 我恨不得飞回家. Many computer words are built from old characters: 服务器 “serving device”, 防火墙 “firewall”, 杀毒 “kill poison”, 黑客 “black guest”.

Servers, firewalls, backups and a hacker blocked: you can now handle a tech crisis in Chinese, and sum it up afterwards.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

day 163 space and energy

Talk about space, rockets, stars and energy in Chinese, say "let alone" with 别说……，都/也……, and ask a favour "for someone's sake" with 看在X的面子上.

Space and energy are in the news every week in China, from rocket launches to nuclear power. And 看在……的面子上 is how favours really get done.

words

word	pinyin	meaning	example
宇宙	yǔzhòu	universe	宇宙到底有多大? Just how big is the universe?
星球	xīngqiú	planet, heavenly body	地球是一个美丽的星球。 The Earth is a beautiful planet.
星系	xīngxì	galaxy	宇宙里有无数个星系。 There are countless galaxies in the universe.
星座	xīngzuò	constellation; star sign	天气好的晚上，能看到很多星座。 On a clear night you can see lots of constellations.
恒星	héngxīng	star (a sun)	太阳是一颗恒星。 The Sun is a star.
行星	xíngxīng	planet	地球是围着太阳转的一颗行星。 The Earth is a planet that goes round the Sun.
卫星	wèixīng	satellite	月亮是地球的卫星。 The Moon is the Earth's satellite.
陨石	yǔnshí	meteorite	博物馆里有一块从天上掉下来的陨石。 The museum has a meteorite that fell from the sky.
外星人	wàixīngrén	alien, extraterrestrial	你相信有外星人吗? Do you believe in aliens?
飞碟	fēidié	UFO, flying saucer	他说昨天晚上看见了飞碟。 He says he saw a UFO last night.
飞船	fēichuán	spaceship	飞船已经顺利进入太空。 The spaceship has entered space successfully.
火箭	huǒjiàn	rocket	火箭今天早上成功发射了。 The rocket was launched successfully this morning.
发射	fāshè	launch, fire	这颗卫星是去年发射的。 This satellite was launched last year.
航天	hángtiān	spaceflight, space (industry)	中国的航天事业发展得很快。 China's space programme has developed fast.
航天员	hángtiānyuán	astronaut	航天员在太空里生活了半年。 The astronauts lived in space for six months.
空间站	kōngjiānzhàn	space station	空间站每天绕着地球飞十几圈。 The space station goes round the Earth more than ten times a day.

续航	xùháng	range, battery life	这辆电动车的续航有五百公里。 This electric car has a range of five hundred kilometres.
望远镜	wàngyuǎnjìng	telescope	我们用望远镜看月亮。 We looked at the Moon through a telescope.
雷达	léidá	radar	雷达发现了一架飞机。 The radar picked up a plane.
探测	tàncè	probe, detect	科学家|用机器人探测月球的表面。 Scientists use robots to explore the surface of the Moon.
观测	guāncè	observe (scientifically)	科学家每天晚上都在这里观测天空。 The scientists observe the sky from here every night.
轨迹	guǐjì	track, path	雷达记录下了飞机的轨迹。 The radar recorded the plane's path.
时空	shíkōng	time and space	这部电影讲的是一个穿越时空的故事。 This film is about travelling through time and space.
真空	zhēnkōng	vacuum	太空几乎是真空的。 Space is almost a vacuum.
引擎	yǐnqíng	engine	飞机的引擎突然出了问题。 The plane's engine suddenly developed a fault.
驱动	qūdòng	drive; driver (software)	这辆车是用电驱动的。 This car is driven by electricity.
马力	mǎlì	horsepower	这台机器有一百马力。 This machine has a hundred horsepower.
功率	gōnglǜ	power (watts)	这台空调的功率很大。 This air conditioner is very powerful.
半导体	bàndǎotǐ	semiconductor	芯片是用半导体做的。 Chips are made from semiconductors.
核	hé	stone (of a fruit); nucleus	这种水果的核很大，不能吃。 This fruit has a big stone that you can't eat.
核能	hénéng	nuclear energy	很多国家|用核能发电。 Many countries use nuclear energy to make electricity.
核电站	hédiànzhàn	nuclear power station	这座核电站能给几百万个家庭提供电。 This nuclear power station can supply electricity to millions of homes.
电网	diànwǎng	power grid	风能和太阳能发的电都要送进电网。 Electricity from wind and solar power all has to go into the grid.
激光	jīguāng	laser	医生用激光给他做了眼睛手术。 The doctor operated on his eyes with a laser.

pattern 别说……，都/也……，"let alone" (and 看在x的面子上)

别说 | the easy case, | (连) the hard case + 都/也 …

别说 A，(连) B 都/也 … means “let alone A, even B …”: you dismiss the obvious case and jump to a stronger one. Also back today: 看在X的面子上, “for X’s sake”, out of respect for someone: 看在老朋友的面子上, 我就帮你一次.

宇宙有多大？别说普通人，连科学家都说不清楚。 **yǔzhòu yǒu duō dà biéshuō pǔtōng rén lián kēxué jiā dōu shuō bu qīngchu** How big is the universe? Even scientists can’t say for sure, let alone ordinary people.

火箭的马力大得很，别说汽车，连大飞机也比不上。 **huǒjiàn de mǎlì dà de hěn biéshuō qìchē lián dà fēijī yě bǐ bu shàng** A rocket is incredibly powerful: let alone cars, not even big planes come close.

看在你哥哥的面子上，我周六去看看。 **kàn zài nǐ gēge de miànzi shàng wǒ zhōu liù qù kàn kan** For your brother’s sake, I’ll come and take a look on Saturday.

dialogue an evening among the stars

dr zhou

宇宙到底有多大？别说普通人，连科学家都说不清楚。我们只知道，宇宙里有无数个星系，每个星系里又有无数颗恒星。

yǔzhòu dàodǐ yǒu duō dà biéshuō pǔtōng rén lián kēxué jiā dōu shuō bu qīngchu wǒmen zhǐ zhīdào yǔzhòu lǐ yǒu wúshù gè xīngxì měi gè xīngxì lǐ yòu yǒu wúshù kē héngxīng · Just how big is the universe? Even scientists can't say for sure, let alone ordinary people. We only know there are countless galaxies, and countless stars in each.

little sister

我只认识几个星座。周博士，除了地球，别的行星上有生命吗？

wǒ zhǐ rènshi jǐ gè xīngzuò Zhōubóshì chúle dìqiú biéde xíngxīng shàng yǒu shēngmìng ma · I only know a few constellations. Dr Zhou, is there life on any planet besides Earth?

dr zhou

现在还没有发现。别的星球上有没有生命，还是一个谜。所以外星人和飞碟，目前还只是电影里的故事。

xiànzài hái méiyǒu fāxiàn biéde xīngqiú shàng yǒu méiyǒu shēngmìng háishi yí gè mí suǒyǐ wàixīngrén hé fēidié mùqián hái zhǐshì diànyǐng lǐ de gùshi · None has been found yet. Whether there's life on other worlds is still a mystery, so aliens and flying saucers are just film stories for now.

little sister

电影里的外星人都特别聪明，智商比人类高多了！

diànyǐng lǐ de wàixīngrén dōu tèbié cōngmíng zhìshāng bǐ rénlèi gāo duō le · The aliens in films are always so clever, with IQs far higher than ours!

anna

我小时候摸过一块陨石，是从天上掉下来的，特别重。

wǒ xiǎoshíhou mō guo yí kuài yǔnshí shì cóng tiānshàng diào xialai de tèbié zhòng · When I was little I touched a meteorite that had fallen from the sky. It was really heavy.

dr zhou

陨石很有研究价值。现在我们用望远镜和雷达观测天空，记录它们的轨迹；还发射卫星，用机器人去探测别的星球。拍到的照片都存在地面的数据库里。

yǔnshí hěn yǒu yánjiū jiàzhí xiànzài wǒmen yòng wàngyuǎnjìng hé léidá guāncè tiānkōng jìlù tāmen de guǐjì hái fāshè wèixīng yòng jīqìrén qù tàncè biéde xīngqiú pāi dào de zhàopiàn dōu cúnzài dìmiàn de shùjùkù lǐ · Meteorites are very valuable for research. Today we watch the sky with telescopes and radar and record their paths; we also launch satellites and send robots to explore other worlds. All the photos they take are stored in databases on the ground.

xiaoming

卫星上的芯片一定特别复杂吧？中国的航天发展得真快。我第一次看火箭发射的时候，激动得要命。

wèixīng shàng de xīnpiàn yídìng tèbié fùzá ba Zhōngguó de hángtiān fāzhǎn de zhēn kuài wǒ dì yī cì kàn huǒjiàn fāshè de shíhou jīdòng de yàomìng · The chips on satellites must be incredibly complex, surely? China's space programme has moved so fast. The first time I watched a rocket launch, I was terribly excited.

dr zhou

现在航天员可以在空间站里住半年。飞船发射以后，几个小时就能到。太空几乎是真空，航天员到外面工作，要穿特制的衣服。当航天员要有坚强的意志，训练非常艰苦。

xiànzài hángtiānyuán kěyǐ zài kōngjiānzhàn lǐ zhù bàn nián fēichuán fāshè yǐhòu jǐ gè xiǎoshí jiù néng dào tàikōng jīhū shì zhēnkōng hángtiānyuán dào wàimiàn gōngzuò yào chuān tèzhì de yīfu dāng hángtiānyuán yào yǒu jiānqiáng de yìzhì xùnliàn fēicháng jiānkǔ · Today astronauts can live on the space station for six months. Once a spaceship is launched it can get there in a few hours. Space is almost a vacuum, so astronauts working outside wear specially made suits. Being an astronaut takes a strong will: the training is very tough.

little sister

电影里的飞船一下子就能穿越时空！

diànyǐng lǐ de fēichuán yíxià zi jiù néng chuānyuè shíkōng · In films, spaceships jump through time and space in a flash!

dr zhou

那是电影。真正的飞船要靠引擎驱动。火箭的马力大得很，别说汽车，连大飞机也比不上。

nà shì diànyǐng zhēnzhèng de fēichuán yào kào yǐnqíng qūdòng huǒjiàn de mǎlì dà de hěn biéshuō qìchē lián dà fēijī yě bǐ bu shàng · That's the movies. Real spaceships are driven by engines. And rockets are incredibly powerful: let alone cars, not even big planes can match them.

xiaoming 火箭发射的时候，几公里以外的地面都在震动。
huǒjiàn fāshè de shíhou jǐ gōnglǐ yǐwài de dìmiàn dōu zài zhèndòng · When a rocket launches, the ground shakes even several kilometres away.

anna 周博士，能源方面呢？现在的电动车，续航还是太短。
Zhōubóshì néngyuán fāngmiàn ne xiànzài de diàndòngchē xùháng háishi tài duǎn · Dr Zhou, what about energy? Electric cars today still have too short a range.

dr zhou 关键是电池和半导体技术。另外，发电也很重要：很多国家用核能发电，一座核电站能给几百万个家庭提供电。风能和太阳能发的电，也都要送进电网。功率越大，对电网的要求就越高。
guānjiàn shì diànchí hé bàndǎotǐ jìshù lìngwài fādiàn yě hěn zhòngyào hěn duō guójiā yòng hénéng fādiàn yí zuò hédiànzhàn néng gěi jǐ bǎi wàn gè jiātíng tígōng diàn fēng néng hé tàiyángnéng fā de diàn yě dōu yào sòng jìn diànwǎng gōnglǜ yuè dà duì diànwǎng de yāoqiú jiù yuè gāo · The key is battery and semiconductor technology. Generating power matters too: many countries use nuclear energy, and one nuclear power station can supply millions of homes. Electricity from wind and solar all has to go into the grid, and the more power, the more the grid has to handle.

xiaoming 核电站安全吗？
hédiànzhàn ānquán ma · Are nuclear power stations safe?

dr zhou 现在的标准非常严格。核技术用好了，能造福人类；用不好，就很危险。还有激光，现在医院和工厂都离不开它。
xiànzài de biāozhǔn fēicháng yángé hé jìshù yòng hǎo le néng zàofú rénlèi yòng bu hǎo jiù hěn wēixiǎn hái yǒu jīguāng xiànzài yīyuàn hé gōngchǎng dōu lí bu kāi tā · The standards today are very strict. Used well, nuclear technology benefits humanity; used badly, it's very dangerous. Then there are lasers: hospitals and factories can't do without them now.

little sister 周博士，我们学校的团队要参加下个月的科学节，做一个能用手机遥控的小机器人，现在还在调试。您能不能来指导一下？
Zhōubóshì wǒmen xuéxiào de tuánduì yào cānjiā xià gè yuè de kēxué jié zuò yí gè néng yòng shǒujī yáokòng de xiǎo jīqìrén xiànzài hái zài tiáoshì nín néng bu néng lái zhǐdǎo yíxià · Dr Zhou, my university team is entering next month's science fair with a little robot you can control from a phone, and we're still testing it. Could you come and give us some advice?

dr zhou 我最近忙得很……
wǒ zuìjìn máng de hěn · I'm very busy at the moment …

xiaoming 周博士，看在我的面子上，帮帮她吧！她很有天赋。
Zhōubóshì kàn zài wǒ de miànzi shàng bāng bang tā ba tā hěn yǒu tiānfù · Dr Zhou, for my sake, please help her! She's really talented.

dr zhou 哈哈，好吧。看在你这个老朋友的面子上，我周六去看看。
hā hā hǎo ba kàn zài nǐ zhège lǎo péngyou de miànzi shàng wǒ zhōu liù qù kàn kan · Ha ha, all right. For old friendship's sake, I'll come and have a look on Saturday.

write it trace the grey, then write your own

宇
yǔ
space

宙
zhòu
time

擎
qíng
lift up

good to know · 恒星 is a star like the Sun, 行星 a planet that circles one, 卫星 a moon or satellite that circles a planet. 星球 is any heavenly body. 面子 is “face”: 看在……的面子上 asks a favour on the strength of a relationship, and 给面子 is to show someone respect.

Stars, rockets, a space station and a favour granted: you can now talk about the universe in Chinese, and get people to help you.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

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day 164 physics and chemistry

Chinese HSK 7–9 in 193 days
unit 22 · science and technology

Talk about basic physics and chemistry in Chinese (forces, light, heat, metals and solutions), and scold gently with 不是我说你 and 你看你.

Science words turn up in cooking, cleaning and the news as much as in class. And 不是我说你 and 你看你 are how Chinese families tell each other off, kindly.

words

word	pinyin	meaning	example
定律	dìnglǜ	(scientific) law	这是物理里最重要的定律之一。 This is one of the most important laws in physics.
公式	gōngshì	formula	这道题用这个公式就能算出来。 You can work this problem out with this formula.
惯性	guànxìng	inertia	汽车突然停下，人会因为惯性往前冲。 When a car stops suddenly, inertia throws you forward.
浮力	fúlì	buoyancy	船能浮在水上，是因为有浮力。 A boat floats on water because of buoyancy.
摩擦	mócā	friction; rub; clash	两只手互相摩擦，就会变热。 Rub your hands together and they get warm.
杠杆	gànggǎn	lever	用杠杆可以很轻松地抬起重东西。 With a lever you can lift heavy things easily.
高压	gāoyā	high pressure, high voltage	高压电很危险，不要靠近。 High-voltage power is dangerous: keep away.
对流	duìliú	convection	热空气上升，冷空气下降，这就是对流。 Warm air rises and cold air sinks: that's convection.
反射	fǎnshè	reflect	镜子能反射阳光。 A mirror reflects sunlight.
折射	zhéshè	refract	筷子放在水里看起来是弯的，这是光的折射。 A chopstick in water looks bent: that's refraction.
照射	zhàoshè	shine on, light up	阳光照射在湖上，特别漂亮。 The sunlight on the lake is beautiful.
投射	tóushè	cast, project	灯光把我们的影子投射在墙上。 The light cast our shadows on the wall.
辐射	fúshè	radiation; radiate	手机的辐射其实很小。 The radiation from a phone is actually very small.
放射	fàngshè	emit, radiate	太阳向四周放射出光和热。 The Sun sends out light and heat in every direction.
振动	zhèndòng	vibrate	手机在桌子上振动了一下。 The phone buzzed on the table.

荧光	yíngguāng	fluorescence; fluorescent	这支笔写出来的字会发荧光。 The writing from this pen glows.
磁铁	cítiě	magnet	冰箱上贴着几块磁铁。 There are a few magnets on the fridge.
绝缘	juéyuán	insulate; insulated	电线外面那一层是绝缘的。 The outer layer of the wire is insulated.
电线	diànxiàn	electric wire	老房子的电线该换了。 The wiring in the old house needs replacing.
钙	gài	calcium	牛奶里有很多钙。 Milk has a lot of calcium in it.
铁	tiě	iron; hard as iron	这扇门是铁做的。 This door is made of iron.
钢铁	gāngtiě	steel; iron and steel	这座城市以前是有名的钢铁基地。 This city used to be a famous centre of steelmaking.
炼	liàn	smelt, refine	古人很早就学会了炼铁。 People learned to smelt iron long ago.
铸造	zhùzào	cast (metal)	这口大钟是明朝铸造的。 This great bell was cast in the Ming dynasty.
提炼	tíliàn	refine, extract	这种药是从植物里提炼出来的。 This medicine is extracted from a plant.
腐蚀	fǔshí	corrode	海水会腐蚀铁。 Seawater corrodes iron.
溶解	róngjiě	dissolve	糖很快就在热水里溶解了。 The sugar soon dissolved in the hot water.
沉淀	chéndiàn	settle; sediment	河水放一个晚上，脏东西就沉淀下来了。 Leave river water overnight and the dirt settles to the bottom.
凝固	nínggù	solidify, set	水在零度会凝固成冰。 Water freezes into ice at zero degrees.
凝结	níngjié	condense	早上，窗户上凝结了一层水。 In the morning there was a film of water on the window.
蒸发	zhēngfā	evaporate	天太热，地上的水很快就蒸发了。 It was so hot that the water on the ground soon evaporated.
沸腾	fèiténg	boil	水在一百度的时候沸腾。 Water boils at a hundred degrees.
结晶	jiéjīng	crystallise; crystal; fruit (of)	海水蒸发以后，会留下盐的结晶。 When seawater evaporates, it leaves salt crystals behind.
浓缩	nóngsuō	concentrate	这瓶果汁是浓缩的，要加水喝。 This juice is concentrated: add water before you drink it.
过滤	guòlǜ	filter	自来水最好过滤以后再喝。 Tap water is best filtered before you drink it.

pattern 不是我说你 and 你看你: gentle scolding

不是我说你，/ 你看你， **what the person did wrong**

不是我说你 (literally “it’s not that I’m criticising you”) softens criticism before it comes: “I hate to say it, but …”. 你看你 “look at you!” points at something silly someone has just done. Both belong to family, friends and close colleagues, and both are half affectionate.

不是我说你，你做实验总是太马虎。 **bú shì wǒ shuō nǐ nǐ zuò shíyàn zǒngshì tài mǎhu** I hate to say it, but you’re always too careless in experiments.

你看你，电线外面绝缘的那层都破了！ **nǐ kàn nǐ diànxiàn wàimiàn juéyuán de nà céng dōu pò le** Look at you: the insulation on that wire is split!

你看你，又忘了戴手套。 **nǐ kàn nǐ yòu wàng le dài shǒutào** Look at you, you’ve forgotten your gloves again.

dialogue a boat in the workshop

dr zhou 你们的机器人是一条小船?

nǐmen de jīqìrén shì yì tiáo xiǎo chuán · Your robot is a little boat?

little sister 对！它靠电池驱动，在河上走，能取水样，还能把水里的垃圾过滤出来。

duì tā kào diànchí qūdòng zài hé shàng zǒu néng qǔ shuǐ yàng hái néng bǎ shuǐ lǐ de lājī guòlǜ chulai · Yes! It runs on a battery, moves along the river, takes water samples and filters the rubbish out of the water.

dr zhou 它怎么知道往哪儿走?

tā zěnme zhīdào wǎng nǎr zǒu · How does it know where to go?

little sister 我们给它编程，设定好路线，它就自己走，还能记录走过的轨迹，用无线网络把数据同步到手机上。

wǒmen gěi tā biānchéng shèdìng hǎo lùxiàn tā jiù zìjǐ zǒu hái néng jìlù zǒu guo de guǐjì yòng wúxiàn wǎngluò bǎ shùjù tóngbù dào shǒujī shàng · We program it and set the route, and it goes by itself. It records the track it has taken, too, and syncs its data to a phone over wireless.

dr zhou 好主意。船能浮在水上，靠的是浮力。你们算过它能装多重的东西吗?

hǎo zhǔyi chuán néng fú zài shuǐ shàng kào de shì fúlì nǐmen suàn guo tā néng zhuāng duō zhòng de dōngxi ma · Good idea. A boat floats thanks to buoyancy. Have you worked out how much weight it can carry?

little sister 算过，用的是课本上的公式。可是它一转弯，就往一边倒。

suàn guo yòng de shì kèběn shàng de gōngshì kěshì tā yì zhuǎn wān jiù wǎng yìbiān dǎo · Yes, with the formula from our textbook. But every time it turns, it tips to one side.

dr zhou 这是惯性。转弯太快，上面的东西会往外冲。把重的电池放低一点，船就平稳了。这是物理定律，谁也改变不了。

zhè shì guànxìng zhuǎn wān tài kuài shàngmiàn de dōngxi huì wǎng wài chōng bǎ zhòng de diànchí fàng dī yìdiǎn chuán jiù píngwěn le zhè shì wùlǐ dìnglǜ shéi yě gǎibiàn bu liǎo · That's inertia. If it turns too fast, everything on top is thrown outwards. Put the heavy battery lower down and the boat will be steady. That's a law of physics: nobody can change it.

xiaoming 你看你，电线外面绝缘的那层都破了！高压的东西千万别碰。

nǐ kàn nǐ diànxiàn wàimiàn juéyuán de nà céng dōu pò le gāoyā de dōngxi qiānwàn bié pèng · Look at you: the insulation on that wire is split! Never touch anything high-voltage.

little sister 哥哥，我知道了，你别说了。

gēge wǒ zhīdào le nǐ biéshuō le · All right, I know. Stop going on.

xiaoming 不是我说你，你做事总是太急。上次做实验，你把一整瓶盐都倒进了水里，根本溶解不了，杯子底下全是沉淀。

bú shì wǒ shuō nǐ nǐ zuò shì zǒngshì tài jí shàng cì zuò shíyàn nǐ bǎ yì zhěng píng yán dōu dào jìn le shuǐ lǐ gēnběn róngjiě bu liǎo bēizi dǐxia quán shì chéndiàn · I hate to say it, but you always rush things. In the last experiment you tipped a whole bottle of salt into the water. It couldn't possibly dissolve, and the bottom of the glass was all sediment.

dr zhou 哈哈，那也是实验。把那杯水加热到沸腾，水蒸发了，就会留下盐的结晶。很多发现就是这么来的。

hā hā nà yě shì shíyàn bǎ nà bēi shuǐ jiārè dào fèiténg shuǐ zhēngfā le jiù huì liúxia yán de jiéjīng hěn duō fāxiàn jiùshì zhème lái de · Ha ha, that's an experiment too. Heat the water until it boils, the water evaporates, and salt crystals are left behind. A lot of discoveries happen that way.

little sister 周博士，船身用铁做好不好?

Zhōubóshì chuán shēn yòng tiě zuò hǎo bu hǎo · Dr Zhou, should we make the hull out of iron?

dr zhou 河水会腐蚀铁，钢铁也会生锈。古人会炼铁，还能铸造大钟，非常了不起；可是做小船，塑料更轻。

hé shuǐ huì fǔshí tiě gāngtiě yě huì shēng xiù gǔrén huì liàn tiě hái néng zhùzào dà zhōng fēicháng liǎobuqǐ kěshì zuò xiǎo chuán sùliào gèng qīng · River water corrodes iron, and steel rusts too. People long ago could smelt iron and even cast great bells, which is amazing; but for a little boat, plastic is lighter.

little sister 我们还想在船上装一个小灯，晚上也能工作。灯光照射到水面上，会不会反射回来?
wǒmen hái xiǎng zài chuán shàng zhuāng yí gè xiǎo dēng wǎnshang yě néng gōngzuò dēngguāng zhàoshè dào shuǐmiàn shàng huì bu huì fǎnshè huilai · We also want a little light on the boat so it can work at night. When the light shines on the water, will it reflect back?

dr zhou 会有反射，也有折射。你们可以把灯光往下投射，再用荧光的颜色画出船的位置。
huì yǒu fǎnshè yě yǒu zhéshè nǐmen kěyǐ bǎ dēngguāng wǎng xià tóushè zài yòng yíngguāng de yánsè huà chū chuán de wèizhì · There'll be reflection, and refraction too. You could aim the light downwards and mark the boat's position with a fluorescent colour.

xiaoming 船上的机器振动得太厉害了。我看可以用磁铁把电池固定住，这样更牢固。
chuán shàng de jīqì zhèndòng de tài lìhai le wǒ kàn kěyǐ yòng cítiě bǎ diànchí gùdìng zhù zhèyàng gèng láogù · The machinery on the boat vibrates far too much. I think we could hold the battery in place with magnets: it'd be more secure.

little sister 上次装电池，说明书上遗漏了一步，折腾了我们一下午。
shàng cì zhuāng diànchí shuōmíngshū shàng yílòu le yí bù zhēteng le wǒmen yí xiàwǔ · Last time we fitted the battery, the instructions left out a step, and it took us a whole afternoon of messing about.

dr zhou 用磁铁可以。收垃圾的那只“手”是一个杠杆，转的地方要减少摩擦。还有，晚上河上的水汽会凝结在船上，胶水要完全凝固以后再下水。
yòng cítiě kěyǐ shōu lājī de nà zhī shǒu shì yí gè gànggǎn zhuǎn de dìfang yào jiǎnshǎo mócā hái yǒu wǎnshang hé shàng de shuǐqì huì níngjié zài chuán shàng jiāoshuǐ yào wánquán nínggù yǐhòu zài xià shuǐ · Magnets will work. The “arm” that picks up rubbish is a lever, so cut down the friction where it turns. And at night the moisture over the river will condense on the boat, so let the glue set completely before it goes in the water.

little sister 我们取的河水里钙很多，烧开以后，壶里有一层白色的东西。
wǒmen qǔ de hé shuǐ lǐ gài hěn duō shāo kāi yǐhòu hú lǐ yǒu yì céng báisè de dōngxi · The river water we took has a lot of calcium: when we boil it, there's a white layer left in the kettle.

dr zhou 对，那就是钙。太阳放射出来的热让水面蒸发，热空气上升，冷空气下降，这是对流。手机和你们这条小船的辐射都很小，不用担心。
duì nà jiùshì gài tàiyáng fàngshè chulai de rè ràng shuǐmiàn zhēngfā rè kōngqì shàngshēng lěng kōngqì xiàjiàng zhè shì duìliú shǒujī hé nǐmen zhè tiáo xiǎo chuán de fúshè dōu hěn xiǎo búyòng dānxīn · Right, that's the calcium. The heat the Sun gives off makes the surface water evaporate; warm air rises and cold air sinks, which is convection. And the radiation from phones and from your little boat is tiny, so don't worry.

little sister 过滤出来的东西，我们想先浓缩，再提炼出有用的材料。
guòlǜ chulai de dōngxi wǒmen xiǎng xiān nóngsuō zài tíliàn chū yǒuyòng de cáiliào · We'd like to concentrate what we filter out and then extract useful materials from it.

dr zhou 想法很好，先把船做稳吧!
xiǎngfǎ hěn hǎo xiān bǎ chuán zuò wěn ba · Great idea, but first get the boat stable!

write it trace the grey, then write your own

辐
fú
spoke (of a wheel)

钙
gài
calcium

good to know · Many science words share 射 “shoot”: 反射 reflect, 折射 refract, 照射 shine on, 投射 project, 辐射 radiation, 放射 emit, 发射 launch. 凝固 is liquid to solid (water to ice), 凝结 is gas to liquid (steam on a window), 蒸发 is liquid to gas, 溶解 is dissolving.

Buoyancy, inertia, reflection, crystals and a brother's scolding: you can now do a science lesson in Chinese.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

day 165 in the lab

Talk about a science lab in Chinese (samples, microscopes, microbes, measuring and error), tease with 你说你一个X，……, and admit a pleasant surprise with (你)还别说.

Labs, tests and measurements are part of health, food and environment news. And 你说你一个X and 还别说 are two of the most natural-sounding things you can say in spoken Chinese.

words

word	pinyin	meaning	example
微生物	wēishēngwù	microorganism	我们身上有无数的微生物。 There are countless microbes on our bodies.
微观	wēiguān	microscopic	在微观世界里，一切都很不一样。 In the microscopic world, everything is very different.
显微镜	xiǎnwēijìng	microscope	用显微镜可以看到细胞。 With a microscope you can see cells.
标本	biāoběn	specimen	博物馆里有很多蝴蝶标本。 The museum has lots of butterfly specimens.
样本	yàngběn	sample	我们从河里取了十个水的样本。 We took ten water samples from the river.
抽样	chōuyàng	take a sample; sampling	这次调查是抽样调查。 This is a sample survey.
胚胎	pēitāi	embryo	鸡蛋里的胚胎要二十一天才能变成小鸡。 The embryo in an egg takes twenty-one days to become a chick.
克隆	kèlóng	clone	科学家克隆了一只羊。 Scientists cloned a sheep.
杂交	zájiāo	cross-breed, hybridise	杂交水稻让很多人吃饱了饭。 Hybrid rice has fed a great many people.
变异	biànyì	mutate; mutation	病毒会不断变异。 Viruses keep mutating.
演化	yǎnhuà	evolve; evolution	地球上的生命经过了几十亿年的演化。 Life on Earth has evolved over billions of years.
解剖	jiěpōu	dissect; anatomy	医生在大学里都学过解剖。 All doctors studied anatomy at university.
膜	mó	membrane; thin film	手机屏幕上贴了一层膜。 There's a protective film on the phone screen.
纤维	xiānwéi	fibre	多吃蔬菜，可以补充纤维。 Eat more vegetables to get more fibre.
载体	zàitǐ	carrier, medium	文字是文化的载体。 Writing is a carrier of culture.
分解	fēnjiě	break down, decompose	塑料袋要几百年才能分解。 A plastic bag takes hundreds of years to break down.
渗	shèn	seep, soak through	雨水慢慢渗进了地下。 The rain slowly soaked into the ground.

中性	zhōngxìng	neutral	这种肥皂是中性的，不伤手。 This soap is neutral, so it's kind to your hands.
显性	xiǎnxìng	dominant (gene); visible	棕色眼睛一般是显性的。 Brown eyes are usually dominant.
橡胶	xiàngjiāo	rubber	轮胎是用橡胶做的。 Tyres are made of rubber.
人造	rénzào	man-made, artificial	这些花是人造的，不是真的。 These flowers are artificial, not real.
原型	yuánxíng	prototype; model	这是新机器人的原型。 This is the prototype of the new robot.
验	yàn	test, examine	医生让我去验血。 The doctor sent me for a blood test.
测定	cèdìng	measure, determine	科学家测定了这块石头的年龄。 Scientists determined the age of this rock.
测算	cèsuàn	estimate, calculate	据测算，这个工程要花三年时间。 By one estimate, the project will take three years.
量化	liànghuà	quantify	有些东西很难量化，比如幸福。 Some things are hard to measure, like happiness.
运算	yùnsuàn	calculate, compute	这台电脑每秒能运算几亿次。 This computer can do hundreds of millions of calculations a second.
精度	jīngdù	precision, accuracy	这台机器的精度非常高。 This machine is extremely precise.
精密	jīngmì	precise, precision	这是一台很精密的仪器。 This is a very precise instrument.
误差	wùchā	error, margin of error	这次测量的误差不到一毫米。 The margin of error in this measurement is under a millimetre.
温度计	wēndùjì	thermometer	温度计显示今天三十八度。 The thermometer says thirty-eight degrees today.
天平	tiānpíng	balance, scales	用天平称一下这些盐有多重。 Weigh this salt on the scales.
器材	qìcái	equipment, materials	体育器材都放在这个房间里。 The sports equipment is all kept in this room.
器械	qìxiè	apparatus, instruments	医院新买了一批医疗器械。 The hospital has bought a batch of new medical equipment.

pattern 你说你一个x，…… (and 还别说)

你说你一个 | X (who you are), | and yet you ...!

你说你一个X，…… means “here you are, an X, and you ...!”: you remind someone of who they are, then point out what they can’t or shouldn’t do. It’s teasing or a mild scolding. Also back today: (你)还别说, “you know what, actually ...”, when something turns out better than you expected.

你说你一个工程师，怎么连天平都放不平？ **nǐ shuō nǐ yí gè gōngchéngshī zěnme lián tiānpíng dōu fàng bu píng** Here you are, an engineer, and you can’t even set a balance level?

你说你一个大学生，这么快就成了小科学家了！ **nǐ shuō nǐ yí gè dàxuéshēng zhème kuài jiù chéng le xiǎo kēxué jiā le** Look at you, a university student, and already a little scientist!

你还别说，看微生物比看书有意思多了。 **nǐ hái biéshuō kàn wēishēngwù bǐ kàn shū yǒu yìsi duō le** You know what, looking at microbes is far more fun than reading about them.

dialogue a drop of river water

dr zhou 欢迎来我的实验室。这些器材都很精密，请大家小心。
huānyíng lái wǒ de shíyànshì zhèxiē qìcái dōu hěn jīngmì qǐng dàjiā xiǎoxīn · Welcome to my lab. All this equipment is very precise, so please be careful.

little sister 哇，这么多显微镜！架子上还有好多标本：蝴蝶、小鱼……这个是什么？
wā zhème duō xiǎnwēijìng jiàzi shàng hái yǒu hǎoduō biāoběn húdié xiǎo yú zhège shì shénme · Wow, so many microscopes! And all these specimens on the shelves: butterflies, little fish … what's this one?

dr zhou 那是鸡蛋里的胚胎，是一位研究生物的同事做的。
nà shì jīdàn lǐ de pēitāi shì yí wèi yánjiū shēngwù de tóngshì zuò de · That's an embryo from an egg. A colleague who studies biology made it.

xiaoming 我们带来了河水的样本，一共二十瓶，是在河上不同的地方抽样取的，还没有过滤过。
wǒmen dài lái le hé shuǐ de yàngběn yígòng èrshí píng shì zài hé shàng bù tóng de dìfang chōuyàng qǔ de hái méiyǒu guòlǜ guo · We've brought the river water samples: twenty bottles, taken at different points along the river, not yet filtered.

dr zhou 好。先用温度计量一下水的温度，再用天平称一称……小明，你说你一个工程师，怎么连天平都放不平？
hǎo xiān yòng wēndùjì liáng yíxià shuǐ de wēndù zài yòng tiānpíng chēng yi cheng Xiǎomíng nǐ shuō nǐ yí gè gōngchéngshī zěnme lián tiānpíng dōu fàng bu píng · Good. First take the water temperature with the thermometer, then weigh them on the balance … Xiaoming, here you are, an engineer, and you can't even set the balance level?

xiaoming 哈哈，我平时用的都是电脑，这些老器械我真没用过。
hā hā wǒ píngshí yòng de dōu shì diànnǎo zhèxiē lǎo qìxiè wǒ zhēn méi yòng guo · Ha ha, I spend my life on computers. I've honestly never used these old instruments.

dr zhou 没关系，天平跟杠杆的道理一样，两边一样重就平了。我们来看看水里的微生物。在微观世界里，一滴水就是一座大城市。
méi guānxi tiānpíng gēn gànggǎn de dàolǐ yíyàng liǎng biān yíyàng zhòng jiù píng le wǒmen lái kàn kan shuǐ lǐ de wēishēngwù zài wēiguān shìjiè lǐ yì dī shuǐ jiùshì yí zuò dà chéngshì · Never mind: a balance works like a lever, and it's level when both sides weigh the same. Let's look at the microbes in the water. In the microscopic world, one drop of water is a big city.

little sister 我看见了！有的在动，有的好像被一层膜包着。
wǒ kànjiàn le yǒude zài dòng yǒude hǎoxiàng bèi yì céng mó bāo zhe · I can see them! Some are moving, and some seem to be wrapped in a sort of membrane.

dr zhou 对。显微镜里的光经过反射和折射，才能把它们放大。有的微生物能把垃圾分解掉，可是水里的塑料和人造纤维，它们分解不了。
duì xiǎnwēijìng lǐ de guāng jīngguò fǎnshè hé zhéshè cái néng bǎ tāmen fàngdà yǒude wēishēngwù néng bǎ lājī fēnjiě diào kěshì shuǐ lǐ de sùliào hé rénzào xiānwéi tāmen fēnjiě bu liǎo · Right. In the microscope, the light is reflected and refracted, and that's what magnifies them. Some microbes can break rubbish down, but they can't break down the plastic and man-made fibres in the water.

anna 河边的工厂会不会有带腐蚀性的脏水渗进河里？
hé biān de gōngchǎng huì bu huì yǒu dài fǔshí xìng de zāng shuǐ shèn jìn hé lǐ · Could corrosive dirty water from the factories by the river be seeping into it?

dr zhou 有可能。我们先测定水里有什么，再把它量化，比如每瓶水里有多少塑料。电脑运算一下，就能测算出整条河的情况。测量都有误差，不过这些仪器的精度很高。
yǒu kěnéng wǒmen xiān cèdìng shuǐ lǐ yǒu shénme zài bǎ tā liànghuà bǐrú měi píng shuǐ lǐ yǒu duōshao sùliào diànnǎo yùnsuàn yíxià jiù néng cèsuàn chū zhěng tiáo hé de qíngkuàng cèliáng dōu yǒu wùchā búguò zhèxiē yíqì de jīngdù hěn gāo · It's possible. First we determine what's in the water, then we quantify it, for example how much plastic there is in each bottle. A computer runs the numbers and estimates the state of the whole river. Every measurement has some error, but these instruments are very accurate.

xiaoming 这么多数据，用大数据的方法分析就更快了。
zhème duō shùjù yòng dàshùjù de fāngfǎ fēnxī jiù gèng kuài le · With this much data, big-data methods would make the analysis quicker.

little sister 你还别说，这比看书有意思多了！
nǐ hái biéshuō zhè bǐ kàn shū yǒu yìsi duō le · You know what, this is far more fun than reading books!

dr zhou 还别说，你们的船如果能每天自动取样，就是一个很好的原型。外面再包一层橡胶，就不怕撞了。
hái biéshuō nǐmen de chuán rúguǒ néng měi tiān zìdòng qǔ yàng jiùshì yí gè hěn hǎo de yuánxíng wàimiàn zài bāo yì céng xiàngjiāo jiù bú pà zhuàng le · Actually, if your boat could take samples automatically every day, it would make a very good prototype. Wrap it in rubber, and it won't mind bumping into things.

anna 周博士，您也研究过生物吗？
Zhōubóshì nín yě yánjiū guo shēngwù ma · Dr Zhou, have you studied biology too?

dr zhou 研究过一点。比如杂交水稻，就是把两种水稻的优点放在一起；病毒会不断变异；地球上的生命一直在演化。克隆又是另一回事了。
yánjiū guo yìdiǎn bǐrú zájiāo shuǐdào jiùshì bǎ liǎng zhǒng shuǐdào de yōudiǎn fàng zài yìqǐ bìngdú huì búduàn biànyì dìqiú shàng de shēngmìng yìzhí zài yǎnhuà kèlóng yòu shì lìng yì huí shì le · A little. Take hybrid rice: it puts the strengths of two kinds of rice together. Viruses keep mutating, and life on Earth is always evolving. Cloning is something else again.

little sister 周博士真博学！我在课上学过：基因是遗传信息的载体，眼睛的颜色有的是显性的。
Zhōubóshì zhēn bóxué wǒ zài kè shàng xué guo jīyīn shì yíchuán xìnxī de zàitǐ yǎnjing de yánsè yǒude shì xiǎnxìng de · Dr Zhou, you know so much! We learned in class that genes carry hereditary information, and that some eye colours are dominant.

dr zhou 没错。这条河的水是中性的，还不算太坏。最后，有几瓶样本底下有沉淀，我们把它们再验一遍。以前的科学家要解剖很多动物，现在我们有了更好的方法。
méi cuò zhè tiáo hé de shuǐ shì zhōngxìng de hái bú suàn tài huài zuìhòu yǒu jǐ píng yàngběn dǐxia yǒu chéndiàn wǒmen bǎ tāmen zài yàn yí biàn yǐqián de kēxué jiā yào jiěpōu hěn duō dòngwù xiànzài wǒmen yǒu le gèng hǎo de fāngfǎ · Exactly. The river water is neutral, so it's not too bad. Finally, a few samples have sediment at the bottom, so we test them again. Scientists used to dissect a lot of animals; now we have better methods.

little sister 有沉淀的样本，我们可以先加热到沸腾，再看看。
yǒu chéndiàn de yàngběn wǒmen kěyǐ xiān jiārè dào fèiténg zài kàn kan · For the samples with sediment, we could heat them to boiling first and then take another look.

anna 你说你一个大学生，这么快就成了小科学家了！
nǐ shuō nǐ yí gè dàxuéshēng zhème kuài jiù chéng le xiǎo kēxué jiā le · Look at you, a university student, and already a little scientist!

write it trace the grey, then write your own

膜
mó
membrane; thin film

纤
xiān
fine

good to know · 样本 is a sample you test (a water sample); 标本 is a specimen you keep (a butterfly on a pin); 原型 is a prototype. 测定 measures and pins down, 测算 estimates by calculation, 量化 turns something into numbers.

Samples, microscopes, microbes and margins of error: you can now find your way round a lab in Chinese.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

day 166 shapes, parts and machines

Describe shapes, sizes, parts and controls of a machine in Chinese, and cut a long explanation short with 简而言之.

Whether you are building something, buying something or reading instructions, you need words for shapes, parts and buttons. And 简而言之 gets you from a long explanation to the point.

words

word	pinyin	meaning	example
简而言之	jiǎnéryánzhī	in short, in a word	简而言之，这个计划行不通。 In short, this plan won't work.
尖锐	jiānruì	sharp, pointed; incisive	记者提了一个很尖锐的问题。 The journalist asked a very pointed question.
锋利	fēnglì	sharp (of a blade)	这把刀很锋利，小心手。 This knife is very sharp: mind your hands.
平坦	píngtǎn	flat, level	这条路又宽又平坦。 This road is wide and level.
半径	bànjìng	radius	这个圆的半径是五厘米。 The radius of this circle is five centimetres.
直径	zhíjìng	diameter	这个轮子的直径是一米。 This wheel is a metre across.
直线	zhíxiàn	straight line; direct	两点之间，直线最短。 The shortest distance between two points is a straight line.
曲线	qūxiàn	curve	这条曲线表示一年里温度的变化。 This curve shows how the temperature changes over a year.
平面	píngmiàn	plane, flat surface	桌子的表面是一个平面。 A table top is a flat surface.
三角	sānjiǎo	triangle; triangular	他把面包切成了三角的小块。 He cut the bread into little triangles.
椭圆	tuǒyuán	ellipse, oval	地球绕太阳的轨道是一个椭圆。 The Earth's orbit round the Sun is an ellipse.
图形	túxíng	figure, shape, graphic	孩子们在纸上画各种图形。 The children are drawing all kinds of shapes on paper.
整数	zhěngshù	whole number, integer	一、二、三都是整数。 One, two and three are all whole numbers.
跨度	kuàdù	span	这座桥的跨度有一千多米。 This bridge has a span of over a thousand metres.
骨架	gǔjià	skeleton, framework	这座楼的骨架是钢铁做的。 The building's frame is made of steel.
支架	zhījià	stand, support	把手机放在支架上看视频。 Put the phone on the stand to watch videos.

部件	bùjiàn	component, part	这台机器有上千个部件。 This machine has over a thousand components.
零件	língjiàn	(spare) part	这辆自行车的零件都很好买。 Parts for this bike are easy to buy.
配件	pèijiàn	accessory, fitting	这款手机的配件很齐全。 This phone comes with a full set of accessories.
装置	zhuāngzhì	device, installation; install	每个房间都有报警装置。 Every room has an alarm device.
阀门	fámén	valve	用完煤气，记得关上阀门。 When you've finished with the gas, remember to close the valve.
按钮	ànniǔ	button	按一下这个红色的按钮，机器就停了。 Press this red button and the machine stops.
手动	shǒudòng	manual, hand-operated	这辆车是手动的，不是自动的。 This car is a manual, not an automatic.
便携式	biànxiéshì	portable	我买了一台便携式的打印机。 I bought a portable printer.
操控	cāokòng	control, operate	这架小飞机可以用手机操控。 You can fly this little plane from your phone.
操纵	cāozòng	operate; manipulate	有人在背后操纵市场价格。 Someone is manipulating market prices behind the scenes.
配置	pèizhì	configure; configuration, specs	这台电脑的配置很高。 This computer has a high spec.
失灵	shīlíng	fail, stop working	刹车突然失灵了。 The brakes suddenly failed.
尖端	jiānduān	cutting-edge; tip	这家公司掌握了很多尖端技术。 This company has a lot of cutting-edge technology.
前沿	qiányán	frontier, forefront	她一直在科学研究的前沿工作。 She has always worked at the frontier of scientific research.

pattern 简而言之, "in short"

a long explanation ...。 **简而言之，** **the point, in one short sentence。**

简而言之 means "to put it briefly": after a long or technical explanation, it gives the point in one short sentence. It is a little formal, good for presentations, reports and explaining things. Compare 概括来说, which sums up a list of points: 简而言之 is more about cutting a long story short.

船太窄，电池太高，转弯又太快。简而言之，它不稳。 **chuán tài zhǎi diànchí tài gāo zhuǎn wān yòu tài kuài jiǎnéryánzhī tā bù wěn** The boat is too narrow, the battery too high and the turns too sharp. In short, it isn't stable.

我们不是在操纵自然，而是在了解自然。简而言之，科学是为了更懂这个世界。 **wǒmen bú shì zài cāozòng zìrán ér shì zài liǎojiě zìrán jiǎnéryánzhī kēxué shì wèile gèng dǒng zhège shìjiè** We aren't controlling nature, we're understanding it. In short, science is about understanding the world better.

零件都到了，图纸也改好了。简而言之，我们下周就能下水了。 **língjiàn dōu dào le túzhǐ yě gǎi hǎo le jiǎnéryánzhī wǒmen xià zhōu jiù néng xià shuǐ le** All the parts have arrived and the drawings are corrected. In short, we can go in the water next week.

xiaoming 我们先看图纸。这是第二个原型。船的骨架是椭圆的，长一米，最宽的地方半米。
wǒmen xiān kàn túzhǐ zhè shì dì èr gè yuánxíng chuán de gǔjià shì tuǒyuán de cháng yì mǐ zuì kuān de dìfang bàn mǐ · Let's look at the drawings first. This is the second prototype. The frame of the boat is oval: a metre long and half a metre at the widest point.

little sister 为什么不做成三角的？前面尖一点，走得快。
wèi shénme bú zuò chéng sānjiǎo de qiánmiàn jiān yìdiǎn zǒu de kuài · Why not make it triangular? Pointier at the front, so it goes faster.

xiaoming 前面可以尖，可是后面要宽，放电池才稳，浮力也更大。也别做得太尖锐，撞到人就不好了。船底要平坦，放在桌子上不会倒。
qiánmiàn kěyǐ jiān kěshì hòumiàn yào kuān fàng diànchí cái wěn fúlì yě gèng dà yě bié zuò de tài jiānruì zhuàng dào rén jiù bù hǎo le chuán dǐ yào píngtǎn fàng zài zhuōzi shàng bú huì dǎo · The front can be pointed, but the back has to be wide so the battery sits steady, and it floats better too. And don't make it too sharp, or it'll hurt someone if it hits them. The bottom has to be flat so it stands on a table without falling over.

anna 我带来了台灯工厂的木匠师傅做的支架，可以放电池。师傅的刀真锋利，每一面都切得很平。
wǒ dài lái le táidēng gōngchǎng de mùjiàng shīfu zuò de zhījià kěyǐ fàng diànchí shīfu de dāo zhēn fēnglì měi yímiàn dōu qiē de hěn píng · I've brought a stand made by the carpenter at the lamp factory, to hold the battery. His knife must be really sharp: every face is cut perfectly flat.

xiaoming 太好了。支架外面再包一层橡胶，可以减少振动。图纸上是一个平面，做出来就是立体的了。轮子的直径是十厘米，半径就是五厘米。
tài hǎo le zhījià wàimiàn zài bāo yì céng xiàngjiāo kěyǐ jiǎnshǎo zhèndòng túzhǐ shàng shì yí gè píngmiàn zuò chulai jiùshì lìtǐ de le lúnzi de zhíjìng shì shí límǐ bànjìng jiùshì wǔ límǐ · Brilliant. Wrap the stand in a layer of rubber and it'll cut down the vibration. On the drawing it's a flat plane; when you build it, it becomes three-dimensional. The wheels are ten centimetres across, so the radius is five.

little sister 用公式一算就知道了。电脑运算的结果是九点八厘米，我们取整数，十厘米，这点误差没关系。轮子在岸上走直线，转弯的时候走一条曲线。
yòng gōngshì yí suàn jiù zhīdào le diànnǎo yùnsuàn de jiéguǒ shì jiǔ diǎn bā límǐ wǒmen qǔ zhěngshù shí límǐ zhè diǎn wùchā méi guānxi lúnzi zài àn shàng zǒu zhíxiàn zhuǎn wān de shíhou zǒu yì tiáo qūxiàn · Work it out with the formula and you'll see. The computer's result was 9.8 centimetres; we rounded it to a whole number, ten: that small an error doesn't matter. On land the wheels go in a straight line and follow a curve when they turn.

xiaoming 这些零件都是买的，规格都匹配，部件我们自己装。配件里还缺一个阀门，是排水用的。
zhèxiē língjiàn dōu shì mǎi de guīgé dōu pǐpèi bùjiàn wǒmen zìjǐ zhuāng pèijiàn lǐ hái quē yí gè fámén shì pái shuǐ yòng de · We bought all these parts and their specifications all match; we put the components together ourselves. The only fitting missing is a valve, for letting water out.

little sister 船上有三个按钮：红色的是停，绿色的是开，黄色的是手动。
chuán shàng yǒu sān gè ànniǔ hóngsè de shì tíng lǜsè de shì kāi huángsè de shì shǒudòng · There are three buttons on the boat: red is stop, green is go, yellow is manual.

anna 平时用手机操控吗？要是遥控失灵了怎么办？
píngshí yòng shǒujī cāokòng ma yàoshi yáokòng shīlíng le zěnme bàn · Normally you steer it from a phone? What if the remote control fails?

xiaoming 船上有一个安全装置：信号断了十秒，它就自己回到岸边。电脑是便携式的，放在包里就能带走。
chuán shàng yǒu yí gè ānquán zhuāngzhì xìnhào duàn le shí miǎo tā jiù zìjǐ huí dào àn biān diànnǎo shì biànxiéshì de fàng zài bāo lǐ jiù néng dài zǒu · There's a safety device on board: if the signal drops for ten seconds, it comes back to the bank by itself. The computer is a portable one, so it goes in a bag.

little sister 电线外面都包了绝缘的材料，不怕进水。
diànxiàn wàimiàn dōu bāo le juéyuán de cáiliào bú pà jìn shuǐ · All the wires are wrapped in insulation, so it won't matter if water gets in.

dr zhou （进来）不错！这些图形画得很清楚。收垃圾的那只“手”，跨度有多大?
jìnlái búcuò zhèxiē túxíng huà de hěn qīngchu shōu lājī de nà zhī shǒu kuàdù yǒu duō dà · (coming in) Very nice! These diagrams are really clear. How wide is the span of the arm that picks up rubbish?

little sister 四十厘米。周博士，您觉得我们的电脑配置够不够？跟船上的系统兼容吗?
sìshí límǐ Zhōubóshì nín juéde wǒmen de diànnǎo pèizhì gòu búgòu gēn chuán shàng de xìtǒng jiānróng ma · Forty centimetres. Dr Zhou, do you think our computer’s specs are good enough? Is it compatible with the boat’s system?

dr zhou 够了。你们用的技术并不尖端，可是想法很新。很多前沿的研究，也是从这样的小问题开始的。
gòu le nǐmen yòng de jìshù bìng bù jiānduān kěshì xiǎngfǎ hěn xīn hěn duō qiányán de yánjiū yě shì cóng zhèyàng de xiǎo wèntí kāishǐ de · Plenty. Your technology isn’t cutting-edge, but the idea is fresh. A lot of research at the frontier starts with little problems like this.

little sister 有人说，科学家想操纵自然。您怎么看?
yǒu rén shuō kēxué jiā xiǎng cāozòng zìrán nín zěnme kàn · Some people say scientists want to control nature. What do you think?

dr zhou 我不喜欢“操纵”这个词。我们不是在操纵自然，而是在了解自然。简而言之，科学是为了更懂这个世界。
wǒ bù xǐhuan cāozòng zhège cí wǒmen bú shì zài cāozòng zìrán ér shì zài liǎojiě zìrán jiǎnéryánzhī kēxué shì wèile gèng dǒng zhège shìjiè · I don’t like the word “control”. We aren’t controlling nature, we’re understanding it. In short, science is about understanding the world better.

xiaoming 零件都到了，图纸也改好了。简而言之，我们下周就能下水了！
língjiàn dōu dào le túzhǐ yě gǎi hǎo le jiǎnéryánzhī wǒmen xià zhōu jiù néng xià shuǐ le · All the parts are here and the drawings are fixed. In short, we can go in the water next week!

write it trace the grey, then write your own

钮
niǔ
knob, button

椭
tuǒ
oval

good to know · 锋利 is sharp like a blade; 尖锐 is pointed, and also “sharp” for words: 尖锐的问题 a pointed question. 零件 are small parts you can buy; 部件 are bigger assembled parts (components); 配件 are accessories and fittings.

Shapes, sizes, parts and buttons, and the whole thing in a sentence: you can now talk a machine through in Chinese.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

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day 167 tricks and methods

Chinese HSK 7–9 in 193 days
unit 22 · science and technology

Talk about methods, tricks, reasons and lessons learned in Chinese, write a paragraph in logical order (首先, 其次, 然后, 最后, 因此), and say "even if ..., still ..." with 纵然……也……

Reports, essays and the HSK writing paper all reward a paragraph that moves in clear steps. And every project needs a good post-mortem: what went wrong, why, and what to do next.

words

word	pinyin	meaning	example
诀窍	juéqiào	knack, secret	做好这道菜，有什么诀窍吗? Is there a knack to cooking this dish well?
秘诀	mìjué	secret (of success)	她长寿的秘诀是每天散步。 The secret of her long life is a walk every day.
窍门	qiàomén	trick, knack	学外语有没有什么窍门? Are there any tricks to learning a foreign language?
计策	jìcè	stratagem, plan	他想了一个计策，终于说服了对方。 He came up with a plan and finally won the other side round.
招数	zhāoshù	move, trick	这种骗人的招数，我早就见过了。 I've seen this kind of con trick before.
对策	duìcè	countermeasure, response	遇到问题，要尽快想出对策。 When a problem comes up, work out a response quickly.
路子	lùzi	approach, way (of doing)	你的路子不对，换个方法试试。 You're going about it the wrong way: try another method.
两手	liǎngshǒu	two-pronged approach; skill	我们要做好两手准备。 We need to be prepared either way.
点子	diǎnzi	idea	她的点子特别多。 She's full of ideas.
亮点	liàngdiǎn	highlight, bright spot	这次展览最大的亮点是一个机器人。 The highlight of the exhibition is a robot.
设法	shèfǎ	try, find a way	我们会设法尽快解决这个问题。 We'll find a way to solve this as soon as possible.
摸索	mōsuǒ	feel one's way, grope	刚开始工作的时候，什么都要自己摸索。 When you first start work, you have to figure everything out yourself.
破解	pòjiě	crack, solve	科学家终于破解了这个难题。 Scientists have finally cracked this problem.
探究	tànjiū	investigate, inquire into	孩子总是想探究为什么。 Children always want to find out why.
探求	tànqiú	seek, pursue	人类一直在探求宇宙的秘密。 People have always sought the secrets of the universe.

取经	qǔjīng	learn from others' experience	我们去别的公司取经，学习他们的经验。 We visited other companies to learn from their experience.
揭示	jiēshì	reveal, bring to light	这项研究揭示了睡眠的重要性。 This study reveals how important sleep is.
解析	jiěxī	analyse, explain in detail	老师详细解析了这道题。 The teacher went through this question in detail.
检讨	jiǎntǎo	self-criticism; review	他写了一份检讨，承认自己错了。 He wrote a self-criticism, admitting he was wrong.
反省	fǎnxǐng	reflect on oneself	每天睡觉以前，他都会反省一下自己。 Every night before bed he reflects on his day.
正视	zhèngshì	face squarely, face up to	我们要正视自己的缺点。 We have to face up to our shortcomings.
审视	shěnshì	examine closely, scrutinise	他重新审视了自己的计划。 He took a fresh look at his plan.
纵观	zòngguān	survey, take a broad view of	纵观历史，每次技术革命都改变了人们的生活。 Look across history and every technological revolution has changed people's lives.
追溯	zhuīsù	trace back	这个习惯可以追溯到唐朝。 This custom can be traced back to the Tang dynasty.
来历	láilì	origin, background	这件古董的来历不简单。 This antique has quite a history.
缘故	yuángù	reason, cause	也许是天气的缘故，我今天特别累。 Maybe it's the weather, but I'm really tired today.
根源	gēnyuán	root cause	我们要找到问题的根源。 We need to find the root of the problem.
实地	shídì	on the spot, on site	记者到实地采访了当地人。 The reporter went there in person to interview local people.
实体	shítǐ	entity; physical (shop)	现在很多人不去实体店买东西了。 These days a lot of people don't shop in physical stores.
实物	shíwù	the real thing, real object	照片和实物差别很大。 The photo and the real thing are very different.
切身	qièshēn	personal, of direct concern	这件事关系到每个人的切身利益。 This touches everyone's own interests directly.
亲身	qīnshēn	personal, first-hand	这是我的亲身经历。 This happened to me personally.
直观	zhíguān	direct, intuitive, visual	用图表来说明，更直观。 A chart makes it clearer at a glance.
见证	jiànzhèng	witness; testimony	这座老桥见证了城市一百年的变化。 This old bridge has witnessed a hundred years of change in the city.

pattern **a paragraph in logical order (and 纵然……也……)**

首先 …。 | 其次 / 然后 …。 | 最后 … 因此 …。

A clear paragraph moves in one direction: step by step (首先, 其次, 然后, 最后), or from problem to cause to solution, ending with the result (因此, 所以). Pick one order and signpost every step. Also back today: 纵然……也……, "even if …, still …": 纵然失败了，也不是白忙.

首先，我们把船放进河里，记下了它走的路线。其次，我们看了视频，找到了翻船的原因。最后，我们改了设计，把电池放低了。因此，第二次试验成功了。 **shǒuxiān wǒmen bǎ chuán fàng jìn hé lǐ jì xià le tā zǒu de lùxiàn qícì wǒmen kàn le shìpín zhǎo dào le fān chuán de yuányīn zuìhòu wǒmen gǎi le shèjì bǎ diànchí fàng dī le yīncǐ dì èr cì shìyàn chénggōng le** First, we put the boat in the river and recorded its route. Next, we watched the video and found why it capsized. Finally, we changed the design and moved the battery lower. As a result, the second trial succeeded.

我做研究的诀窍是：首先，把现象记下来；其次，找原因；最后，想对策。 **wǒ zuò yánjiū de juéqiào shì shǒuxiān bǎ xiànxiàng jì xialai qícì zhǎo yuányīn zuìhòu xiǎng duìcè** My secret in research is this: first, record what happens; next, find the cause; finally, work out a response.

纵然这次失败了，我们也学到了很多。 **zòngrán zhè cì shībài le wǒmen yě xué dào le hěn duō** Even though we failed this time, we learned a lot.

dialogue what went wrong

little sister 完了！船在河里不走直线，一直转圈，最后还翻了。我们白忙了。
wán le chuán zài hé lǐ bù zǒu zhíxiàn yìzhí zhuǎn quān zuìhòu hái fān le wǒmen bái máng le · That's it! The boat wouldn't go straight: it went round in circles and then capsized. All that work for nothing.

dr zhou 纵然失败了，也不是白忙。我们先正视问题，再找根源。
zòngrán shībài le yě bú shì bái máng wǒmen xiān zhèngshì wèntí zài zhǎo gēnyuán · Even though it failed, it wasn't for nothing. First let's face the problem squarely, then find the root cause.

xiaoming 我先检讨：是我把电池放得太高了。
wǒ xiān jiǎntǎo shì wǒ bǎ diànchí fàng de tài gāo le · I'll own up first: I put the battery too high.

little sister 我也要反省：我太着急，没在实地测试，就直接下水了。
wǒ yě yào fǎnxǐng wǒ tài zháojí méi zài shídì cèshì jiù zhíjiē xià shuǐ le · And I need to look at myself: I was in too much of a hurry and put it straight in without testing it on site.

xiaoming 还有，手动的按钮太小，很不好操控。
hái yǒu shǒudòng de ànniǔ tài xiǎo hěn bù hǎo cāokòng · And the manual buttons are too small: it's hard to control the boat with them.

dr zhou 好。我们重新审视一下设计。我做研究的诀窍是：首先，把现象记下来；其次，找原因；最后，想对策。
hǎo wǒmen chóngxīn shěnshì yíxià shèjì wǒ zuò yánjiū de juéqiào shì shǒuxiān bǎ xiànxiàng jì xialai qícì zhǎo yuányīn zuìhòu xiǎng duìcè · Good. Let's take a fresh look at the design. My secret in research is: first, record what happens; next, find the cause; finally, work out a response.

dr zhou 我来解析一下刚才的视频：船转弯太快，惯性太大，加上风的缘故，才翻了。
wǒ lái jiěxī yíxià gāngcái de shìpín chuán zhuǎn wān tài kuài guànxìng tài dà jiāshàng fēng de yuángù cái fān le · Let me go through the video: the boat turned too fast, so the inertia was too great, and with the wind on top of that, it capsized.

anna 我们公司做台灯的时候也是这样，一开始什么都要自己摸索。后来我们去别的公司取经，就不用再走弯路了。
wǒmen gōngsī zuò táidēng de shíhou yě shì zhèyàng yì kāishǐ shénme dōu yào zìjǐ mōsuǒ hòulái wǒmen qù biéde gōngsī qǔjīng jiù búyòng zài zǒu wānlù le · It was the same when our company made the lamp: at first we had to figure everything out ourselves. Later we went to learn from other companies, and then we didn't have to take detours any more.

professor chen 纵观历史，很多发明都是这样来的。用磁铁找方向，这个办法的来历可以追溯到两千年前。古人也是一点一点探究，才揭示了磁铁的秘密。
zòngguān lìshǐ hěn duō fāmíng dōu shì zhèyàng lái de yòng cítiě zhǎo fāngxiàng zhège bànfǎ de láilì kěyǐ zhuīsù dào liǎngqiān nián qián gǔrén yě shì yìdiǎn yìdiǎn tànjiū cái jiēshì le cítiě de mìmì · Look across history and many inventions came about this way. Using magnets to find direction can be traced back about two thousand years. People back then also investigated bit by bit before they uncovered the magnet's secrets.

little sister 陈教授，您做研究有什么秘诀吗？
Chénjiàoshòu nín zuò yánjiū yǒu shénme mìjué ma · Professor Chen, do you have a secret for research?

professor chen 秘诀谈不上。我的路子是：首先看实物，然后去实地，最后才读书。亲身看见的东西，最直观。
mìjué tán bu shàng wǒ de lùzi shì shǒuxiān kàn shíwù ránhòu qù shídì zuìhòu cái dúshū qīnshēn kànjiàn de dōngxi zuì zhíguān · Hardly a secret. My way is: first look at the real objects, then go to the actual place, and only then read. What you see for yourself is the clearest.

xiaoming 那我们明天再去实地抽样，多取几个样本。我有个点子：在船底加一块重的铁，船就不会翻了。
nà wǒmen míngtiān zài qù shídì chōuyàng duō qǔ jǐ gè yàngběn wǒ yǒu gè diǎnzi zài chuán dǐ jiā yí kuài zhòng de tiě chuán jiù bú huì fān le · Then tomorrow we'll go and take samples on site again, and get a few more. I've got an idea: put a heavy piece of iron in the bottom of the boat, and it won't capsize.

dr zhou 这个窍门很好。不过要做好两手准备：如果还是不稳，就把船的骨架做宽一点。
zhège qiàomén hěn hǎo búguò yào zuò hǎo liǎngshǒu zhǔnbèi rúguǒ háishi bù wěn jiù bǎ chuán de gǔjià zuò

kuān yìdiǎn · That's a good trick. But be ready either way: if it's still not stable, make the boat's frame wider.

little sister 我们先在电脑上测算一下，再把放电池的支架改低一点。我们一定会设法在科学节以前破解这个难题！

wǒmen xiān zài diànnǎo shàng cèsuàn yíxià zài bǎ fàng diànchí de zhījià gǎi dī yìdiǎn wǒmen yídìng huì shèfǎ zài kēxué jié yǐqián pòjiě zhège nántí · First we'll work it out on the computer, then lower the stand that holds the battery. We'll find a way to crack this before the science fair!

xiaoming 妹妹，你还有什么计策？

mèimei nǐ hái yǒu shénme jìcè · So, little sister, any more cunning plans?

little sister 我的招数只有一个：不放弃！

wǒ de zhāoshù zhǐyǒu yí gè bú fàngqì · I've only got one move: never give up!

anna 这条船最大的亮点，是能在河里自动取样，这关系到住在河边的人的切身利益。等船做好了，我们公司的实体店可以帮你们展示。

zhè tiáo chuán zuì dà de liàngdiǎn shì néng zài hé lǐ zìdòng qǔ yàng zhè guānxì dào zhù zài hé biān de rén de qièshēn lìyì děng chuán zuò hǎo le wǒmen gōngsī de shítǐ diàn kěyǐ bāng nǐmen zhǎnshì · The boat's best feature is that it can take samples in the river automatically, and that matters directly to the people who live by the river. When it's finished, our company's shop can display it for you.

professor chen 人类一直在探求自然的规律，你们这条小船也是。这座老桥见证了很多人的失败和成功，今天也见证了你们的第一次。

rénlèi yìzhí zài tànqiú zìrán de guīlǜ nǐmen zhè tiáo xiǎo chuán yě shì zhè zuò lǎo qiáo jiànzhèng le hěn duō rén de shībài hé chénggōng jīntiān yě jiànzhèng le nǐmen de dì yī cì · People have always searched for the laws of nature, and your little boat is doing the same. This old bridge has seen a lot of people fail and succeed, and today it saw your first try.

anna 我来写一段总结：首先，我们找到了问题；其次，我们找到了原因；最后，我们有了新的对策。因此，下一次一定会更好！

wǒ lái xiě yí duàn zǒngjié shǒuxiān wǒmen zhǎo dào le wèntí qícì wǒmen zhǎo dào le yuányīn zuìhòu wǒmen yǒu le xīn de duìcè yīncǐ xià yí cì yídìng huì gèng hǎo · I'll write a short summary: first, we found the problem; next, we found the cause; finally, we have a new plan. So next time will definitely be better!

write it trace the grey, then write your own

诀 jué secret formula	
窍 qiào key point	

good to know · 诀窍, 窍门 and 秘诀 are all "secrets, tricks": 窍门 is a handy trick, 诀窍 a knack, 秘诀 the secret of success. 检讨 is a formal self-criticism (often written), 反省 is reflecting on yourself, 审视 is examining something closely.

A failure faced squarely, a cause found and a plan in three steps: you can now write a clear, logical paragraph in Chinese.
Do this day interactively, with audio and games, free at **wishyou.today/learning**

day 168 mission: the science fair

Follow a whole science fair in Chinese, from the programme notice and a technical crisis at the stand to a talk on space, an open lab, the judges' hard questions and the results, using this unit's words for computers, space, physics, the lab, machines and methods.

A science fair puts all of science and technology in one hall: networks, rockets, experiments, machines and the thinking behind them. If you can follow this day, you can follow a science programme on Chinese TV.

chapter 1 the programme

little sister （读）“城市科学节通知：本届科学节于本周六在大学体育馆举行。活动内容如下：一、周博士讲座：宇宙、航天与能源；二、实验室开放：显微镜、天平、温度计等器材，大家可以亲手试一试；三、大学生机器人比赛。”

dú chéngshì kēxué jié tōngzhī běn jiè kēxué jié yú běn zhōu liù zài dàxué tǐyùguǎn jǔxíng huódòng nèiróng rúxià yī Zhōubóshì jiǎngzuò yǔzhòu hángtiān yǔ néngyuán èr shíyànshì kāifàng xiǎnwēijìng tiānpíng wēndùjì děng qìcái dàjiā kěyǐ qīnshǒu shì yi shi sān dàxuéshēng jīqìrén bǐsài · (reading) “City Science Fair notice: this year's fair takes place this Saturday in the university gym. Programme: one, a talk by Dr Zhou on the universe, spaceflight and energy; two, open lab: microscopes, balances, thermometers and other equipment for everyone to try; three, the university robot competition.”

little sister “参赛的团队请带好原型、图纸和配件。工作人员会检查每个团队的电线和安全装置，高压设备附近请勿进入。现场有免费的无线网络，比赛的数据会同步到科学节的主页上，每位评委都有一台终端，可以随时查看。”

cānsài de tuánduì qǐng dài hǎo yuánxíng túzhǐ hé pèijiàn gōngzuò rényuán huì jiǎnchá měi gè tuánduì de diànxiàn hé ānquán zhuāngzhì gāoyā shèbèi fùjìn qǐng wù jìnrù xiànchǎng yǒu miǎnfèi de wúxiàn wǎngluò bǐsài de shùjù huì tóngbù dào kēxué jié de zhǔyè shàng měi wèi píngwěi dōu yǒu yì tái zhōngduān kěyǐ suíshí chákàn · “Teams taking part should bring their prototypes, drawings and accessories. Staff will check every team's wiring and safety devices; please keep away from high-voltage equipment. There is free Wi-Fi, and competition data will sync to the fair's homepage; each judge has a terminal to check it at any time.”

anna 你们的船准备好了吗？

nǐmen de chuán zhǔnbèi hǎo le ma · Is your boat ready?

little sister 准备好了！上次翻船以后，我们重新审视了设计：船底加了一块铁，电池放低了，骨架也改成了更宽的椭圆。

zhǔnbèi hǎo le shàng cì fān chuán yǐhòu wǒmen chóngxīn shěnshì le shèjì chuán dǐ jiā le yí kuài tiě diànchí fàng dī le gǔjià yě gǎi chéng le gèng kuān de tuǒyuán · Ready! After it capsized last time, we took a fresh look at the design: we put a piece of iron in the bottom, lowered the battery and made the frame a wider oval.

xiaoming 不是我说你，你昨天晚上又只睡了三个小时吧？你看你，眼睛都红了。

bú shì wǒ shuō nǐ nǐ zuótiān wǎnshang yòu zhǐ shuì le sān gè xiǎoshí ba nǐ kàn nǐ yǎnjing dōu hóng le · I hate to say it, but you only slept three hours again last night, didn't you? Look at you, your eyes are all red.

little sister 哥哥，今天别管我了。我紧张得要命！

gēge jīntiān bié guǎn wǒ le wǒ jǐnzhāng de yàomìng · Not today, big brother. I'm terribly nervous!

chapter 2 trouble at the stand

little sister 糟了！遥控失灵了，按哪个按钮都没反应。
zāo le yáokòng shīlíng le àn nǎge ànniǔ dōu méi fǎnyìng · Oh no! The remote control has stopped working: none of the buttons do anything.

xiaoming 别急，我来调试一下。……好在芯片没坏，也不是黑客，问题在软件：你们的新程序跟这台便携式电脑不兼容，内存也不够。
bié jí wǒ lái tiáoshì yíxià hǎozài xīnpiàn méi huài yě bú shì hēikè wèntí zài ruǎnjiàn nǐmen de xīn chéngxù gēn zhè tái biànxiéshì diànnǎo bù jiānróng nèicún yě búgòu · Don't panic, let me take a look … Luckily the chip isn't broken and it isn't hackers: the problem is the software. Your new program isn't compatible with this portable computer, and there isn't enough memory either.

little sister 我们队里写编程的同学都是新手，交互的部分是昨天晚上才写好的。比赛九点半就开始了，怎么办？
wǒmen duì lǐ xiě biānchéng de tóngxué dōu shì xīnshǒu jiāohù de bùfen shì zuótiān wǎnshang cái xiě hǎo de bǐsài jiǔ diǎn bàn jiù kāishǐ le zěnme bàn · The people on our team who do the coding are all beginners, and the interface was only finished last night. The competition starts at half past nine: what do we do?

xiaoming 我先把旧版本卸载了，再装新的，顺便给电脑杀杀毒，把防火墙也打开。你们的数据备份了吗？
wǒ xiān bǎ jiù bǎnběn xièzài le zài zhuāng xīn de shùnbiàn gěi diànnǎo shā shādú bǎ fánghuǒqiáng yě dǎkāi nǐmen de shùjù bèifèn le ma · First I'll uninstall the old version and install the new one, and while I'm at it I'll scan the computer for viruses and switch the firewall on. Have you backed up your data?

little sister 备份了！所有样本的数据都存在数据库里，也同步到了手机上。
bèifèn le suǒyǒu yàngběn de shùjù dōu cún zài shùjùkù lǐ yě tóngbù dào le shǒujī shàng · Yes! All the sample data is in the database and synced to my phone as well.

xiaoming 好。实在不行，就切换成手动，用这个黄色的按钮操控。
hǎo shízài bùxíng jiù qiēhuàn chéng shǒudòng yòng zhège huángsè de ànniǔ cāokòng · Good. If all else fails, switch to manual and steer with this yellow button.

anna 附近的信号也不太好，是不是天线的问题？
fùjìn de xìnhào yě bú tài hǎo shì bu shì tiānxiàn de wèntí · The signal round here isn't great either. Could it be the aerial?

xiaoming 可能是体育馆的墙太厚，把信号屏蔽了。我把船上的天线换个地方……好了，可以了！新程序也激活了。主页的数据我设定好了，每十分钟同步一次。
kěnéng shì tǐyùguǎn de qiáng tài hòu bǎ xìnhào píngbì le wǒ bǎ chuán shàng de tiānxiàn huàn gè dìfang hǎo le kěyǐ le xīn chéngxù yě jīhuó le zhǔyè de shùjù wǒ shèdìng hǎo le měi shí fēnzhōng tóngbù yí cì · Probably the gym walls are so thick they block the signal. Let me move the aerial on the boat … There, that's it! The new program is activated too, and I've set the homepage data to sync every ten minutes.

anna 你们看旁边那个团队：三维的虚拟仿真，大大的液晶显示器，配置真高！
nǐmen kàn pángbiān nàge tuánduì sānwéi de xūnǐ fǎngzhēn dàdà de yèjīng xiǎnshìqì pèizhì zhēn gāo · Look at the team next door: a 3D virtual simulation and a huge LCD monitor. What a spec!

xiaoming 还有一个团队带来了光盘和磁带，要讲数码技术的历史。现在是大数据的时代，网上的信息都在电信公司的光缆和服务器、硬盘里跑来跑去。
hái yǒu yí gè tuánduì dài lái le guāngpán hé cídài yào jiǎng shùmǎ jìshù de lìshǐ xiànzài shì dàshùjù de shídài wǎngshang de xìnxī dōu zài diànxìn gōngsī de guānglǎn hé fúwùqì yìngpán lǐ pǎo lái pǎo qù · And another team has brought CDs and cassettes to talk about the history of digital technology. This is the age of big data: everything online is racing around telecoms fibre cables, servers and hard disks.

little sister 你说你一个工程师，平时那么慢，今天怎么这么快！
nǐ shuō nǐ yí gè gōngchéngshī píngshí nàme màn jīntiān zěnme zhème kuài · Look at you, an engineer who's usually so slow, and so quick today!

xiaoming 还别说，我也觉得今天发挥得不错。
hái biéshuō wǒ yě juéde jīntiān fāhuī de búcuò · You know what, I think I did pretty well today too.

dr zhou 同学们好！我们先从宇宙说起。宇宙里有无数个星系，太阳只是其中一颗普通的恒星，地球是围着它转的一颗行星。天气好的晚上，你们可以看看星座。

tóngxuémen hǎo wǒmen xiān cóng yǔzhòu shuō qǐ yǔzhòu lǐ yǒu wúshù gè xīngxì tàiyáng zhǐshì qízhōng yì kē pǔtōng de héngxīng dìqiú shì wéi zhe tā zhuǎn de yì kē xíngxīng tiānqì hǎo de wǎnshang nǐmen kěyǐ kàn kan xīngzuò · Hello, everyone! Let's start with the universe. It holds countless galaxies; the Sun is just one ordinary star among them, and the Earth is a planet going round it. On a clear night, you can look for the constellations.

dr zhou 有人问我：有没有外星人？飞碟是不是真的？到现在为止，我们还没有发现。不过，天上有时候会掉下来陨石，那可是真的。

yǒu rén wèn wǒ yǒu méiyǒu wàixīngrén fēidié shì bu shì zhēn de dào xiànzài wéizhǐ wǒmen hái méiyǒu fāxiàn búguò tiānshàng yǒu shíhou huì diào xialai yǔnshí nà kěshì zhēn de · People ask me: are there aliens? Are flying saucers real? So far we haven't found any. But meteorites really do fall from the sky sometimes.

dr zhou 我们用望远镜和雷达观测天空，发射卫星和飞船去探测别的星球。火箭靠引擎驱动，马力大得很；雷达会记录下它的轨迹。太空几乎是真空，电影里的飞船能穿越时空，真正的飞船还做不到。

wǒmen yòng wàngyuǎnjìng hé léidá guāncè tiānkōng fāshè wèixīng hé fēichuán qù tàncè biéde xīngqiú huǒjiàn kào yǐnqíng qūdòng mǎlì dà de hěn léidá huì jìlù xià tā de guǐjì tàikōng jīhū shì zhēnkōng diànyǐng lǐ de fēichuán néng chuānyuè shíkōng zhēnzhèng de fēichuán hái zuò bu dào · We watch the sky with telescopes and radar, and launch satellites and spaceships to explore other worlds. A rocket is driven by its engines and is hugely powerful; radar records its path. Space is almost a vacuum. Spaceships in films travel through time and space; real ones can't yet.

dr zhou 现在，航天员可以在空间站里住半年。别说一百年前，就是三十年前，这也是很难想象的。

xiànzài hángtiānyuán kěyǐ zài kōngjiānzhàn lǐ zhù bàn nián biéshuō yìbǎi nián qián jiùshì sānshí nián qián zhè yě shì hěn nán xiǎngxiàng de · Today astronauts can live on the space station for six months. Thirty years ago that was hard to imagine, let alone a hundred years ago.

dr zhou 能源也一样重要：一座核电站的功率很大，核能、风能、太阳能发的电，都要送进电网。核技术用得好，能造福人类。医院里还用激光做手术。电动车的续航越来越长，靠的是电池和半导体技术。

néngyuán yě yíyàng zhòngyào yí zuò hédiànzhàn de gōnglǜ hěn dà hénéng fēng néng tàiyángnéng fā de diàn dōu yào sòng jìn diànwǎng hé jìshù yòng de hǎo néng zàofú rénlèi yīyuàn lǐ hái yòng jīguāng zuò shǒushù diàndòngchē de xùháng yuè lái yuè cháng kào de shì diànchí hé bàndǎotǐ jìshù · Energy matters just as much: a nuclear power station is enormously powerful, and electricity from nuclear, wind and solar all goes into the grid. Used well, nuclear technology benefits humanity. Hospitals use lasers for surgery. Electric cars go further and further on a charge, thanks to battery and semiconductor technology.

dr zhou 研究科学有没有窍门？我的诀窍是：首先，多问为什么；其次，亲手做实验；最后，正视失败。纵然实验失败了，也能从中学到东西。简而言之，科学就在我们身边。

yánjiū kēxué yǒu méiyǒu qiàomén wǒ de juéqiào shì shǒuxiān duō wèn wèi shénme qícì qīnshǒu zuò shíyàn zuìhòu zhèngshì shībài zòngrán shíyàn shībài le yě néng cóngzhōng xué dào dōngxi jiǎnéryánzhī kēxué jiù zài wǒmen shēnbiān · Is there a trick to doing science? My secret is: first, keep asking why; next, do the experiments yourself; finally, face failure honestly. Even when an experiment fails, you can learn from it. In short, science is all around us.

editor lin （小声）安娜，周博士讲得真直观，连孩子都听得懂。

xiǎo shēng Ānnà Zhōubóshì jiǎng de zhēn zhíguān lián háizi dōu tīng de dǒng · (quietly) Anna, Dr Zhou explains things so clearly that even children can follow.

anna 是啊。看在周博士的面子上，今天来的人特别多。

shì a kàn zài Zhōubóshì de miànzi shàng jīntiān lái de rén tèbié duō · Yes. A lot of people have come today on Dr Zhou's account.

chapter 4 the open lab

dr zhou 小朋友们，欢迎来到开放实验室！先做一个最简单的：两只手互相摩擦，是不是变热了？

xiǎopéngyǒumen huānyíng lái dào kāifàng shíyànshì xiān zuò yí gè zuì jiǎndān de liǎng zhī shǒu hùxiāng mócā shì bu shì biàn rè le · Welcome to the open lab, everyone! Let's start with the simplest one: rub your hands together. Getting warm?

little sister 这是一个杠杆，用它抬这块铁，一点也不费劲。这是磁铁，能吸住铁，可是吸不住塑料。电线外面那层是绝缘的。

zhè shì yí gè gànggǎn yòng tā tái zhè kuài tiě yìdiǎn yě bú fèijìn zhè shì cítiě néng xī zhù tiě kěshì xī bu zhù sùliào diànxiàn wàimiàn nà céng shì juéyuán de · This is a lever: with it, lifting this lump of iron is no effort at all. This is a magnet: it picks up iron, but not plastic. And the outer layer of this wire is insulated.

dr zhou 这面镜子能反射阳光。灯光照射到墙上，就把我们的影子投射在上面。这支笔写的字还会发荧光。

zhè miàn jìngzi néng fǎnshè yángguāng dēngguāng zhàoshè dào qiáng shàng jiù bǎ wǒmen de yǐngzi tóushè zài shàngmiàn zhè zhī bǐ xiě de zì hái huì fā yíngguāng · This mirror reflects sunlight. When the lamp shines on the wall, it casts our shadows there. And what you write with this pen glows.

dr zhou 我们来烧水：水沸腾以后会蒸发，水汽遇到冷的玻璃，又凝结成了水。一杯盐水放一个晚上，会留下盐的结晶；水里的脏东西也会沉淀下来。

wǒmen lái shāo shuǐ shuǐ fèiténg yǐhòu huì zhēngfā shuǐqì yùdào lěng de bōli yòu níngjié chéng le shuǐ yì bēi yán shuǐ fàng yí gè wǎnshang huì liúxia yán de jiéjīng shuǐ lǐ de zāng dōngxi yě huì chéndiàn xialai · Now let's boil some water: once it boils it evaporates, and when the steam meets cold glass it condenses back into water. Leave a glass of salt water overnight and salt crystals are left behind, and any dirt in the water settles to the bottom.

xiaoming 周博士，古人怎么炼铁、铸造大钟？

Zhōubóshì gǔrén zěnme liàn tiě zhùzào dà zhōng · Dr Zhou, how did people in the old days smelt iron and cast great bells?

dr zhou 靠很高的温度。铁和钢铁都怕腐蚀，所以海边的铁桥要经常刷漆。物理里有很多定律和公式，比如惯性：车突然停下，人会往前冲。热空气上升，冷空气下降，就是对流。

kào hěn gāo de wēndù tiě hé gāngtiě dōu pà fǔshí suǒyǐ hǎi biān de tiě qiáo yào jīngcháng shuā qī wùlǐ lǐ yǒu hěn duō dìnglǜ hé gōngshì bǐrú guànxìng chē tūrán tíng xià rén huì wǎng qián chōng rè kōngqì shàngshēng lěng kōngqì xiàjiàng jiùshì duìliú · With very high temperatures. Iron and steel both corrode, so iron bridges by the sea need painting often. Physics has many laws and formulas, like inertia: when a car stops suddenly, you lurch forward. Warm air rising and cold air sinking is convection.

little sister 这边可以用显微镜看微观世界。架子上有蝴蝶的标本，还有鸡蛋里的胚胎。你们看，这层薄薄的膜里，有很多微生物。

zhèbiān kěyǐ yòng xiǎnwēijìng kàn wēiguān shìjiè jiàzi shàng yǒu húdié de biāoběn hái yǒu jīdàn lǐ de pēitāi nǐmen kàn zhè céng báo báo de mó lǐ yǒu hěn duō wēishēngwù · Over here you can use the microscopes to see the microscopic world. On the shelf there are butterfly specimens and an embryo from an egg. Look: inside this thin membrane there are lots of microbes.

dr zhou 生命一直在演化，病毒也会变异。杂交水稻、克隆羊，都是科学家的成果。今天我们不解剖动物，只看样本。这些器械都很精密，大家小心。

shēngmìng yìzhí zài yǎnhuà bìngdú yě huì biànyì zájiāo shuǐdào kèlóng yáng dōu shì kēxué jiā de chéngguǒ jīntiān wǒmen bù jiěpōu dòngwù zhǐ kàn yàngběn zhèxiē qìxiè dōu hěn jīngmì dàjiā xiǎoxīn · Life is always evolving, and viruses mutate. Hybrid rice and cloned sheep are both achievements of science. Today we won't dissect any animals, we'll just look at samples. All these instruments are very precise, so be careful.

little sister 这个球是用人造橡胶做的。这杯水是中性的，我们刚刚验过。

zhège qiú shì yòng rénzào xiàngjiāo zuò de zhè bēi shuǐ shì zhōngxìng de wǒmen gānggāng yàn guo · This ball is made of synthetic rubber. And this glass of water is neutral: we've just tested it.

chapter 5 the judges' questions

little sister 各位评委好！我们的机器人是一条小船。它的亮点是：能在河里自动取样，还能过滤水里的垃圾。
gèwèi píngwěi hǎo wǒmen de jīqìrén shì yì tiáo xiǎo chuán tā de liàngdiǎn shì néng zài hé lǐ zìdòng qǔ yàng hái néng guòlǜ shuǐ lǐ de lājī · Good morning, judges! Our robot is a little boat. Its best features: it takes samples from the river automatically, and it filters rubbish out of the water.

professor chen 先说说设计吧。
xiān shuō shuo shèjì ba · Tell us about the design first.

little sister 船的骨架是椭圆的，船底很平坦。轮子的直径是十厘米，半径五厘米。收垃圾的“手”跨度四十厘米，前面锋利的地方都包了橡胶。零件和部件大多是买的，电池的支架是一位木匠师傅做的。后面还有一个阀门，用来排水。
chuán de gǔjià shì tuǒyuán de chuán dǐ hěn píngtǎn lúnzi de zhíjìng shì shí límǐ bànjìng wǔ límǐ shōu lājī de shǒu kuàdù sìshí límǐ qiánmiàn fēnglì de dìfang dōu bāo le xiàngjiāo língjiàn hé bùjiàn dàduō shì mǎi de diànchí de zhījià shì yí wèi mùjiàng shīfu zuò de hòumiàn hái yǒu yí gè fámén yònglái pái shuǐ · The frame is oval and the bottom is flat. The wheels are ten centimetres across, five in radius. The arm that collects rubbish has a forty-centimetre span, and any sharp edges at the front are wrapped in rubber. Most of the parts and components were bought; the battery stand was made by a carpenter. At the back there’s a valve for letting water out.

professor chen 这条船是自己走，还是有人在操纵？
zhè tiáo chuán shì zìjǐ zǒu háishi yǒu rén zài cāozòng · Does the boat steer itself, or is someone controlling it?

little sister 两种都可以：它能自动走，也可以用手机操控。
liǎng zhǒng dōu kěyǐ tā néng zìdòng zǒu yě kěyǐ yòng shǒujī cāokòng · Both: it can go by itself, or you can steer it from a phone.

professor chen 我再问一个尖锐的问题：你们怎么证明数据是对的？
wǒ zài wèn yí gè jiānruì de wèntí nǐmen zěnme zhèngmíng shùjù shì duì de · Let me ask a pointed question: how do you prove your data is right?

little sister 首先，我们在河上不同的地方抽样，一共取了二十个样本。其次，我们在周博士的实验室里用显微镜看微生物，再测定水里有多少塑料和纤维。最后，我们用电脑运算，把结果量化，结果都取了整数。因此，我们的数据是可以检查的。
shǒuxiān wǒmen zài hé shàng bù tóng de dìfang chōuyàng yígòng qǔ le èrshí gè yàngběn qícì wǒmen zài Zhōubóshì de shíyànshì lǐ yòng xiǎnwēijìng kàn wēishēngwù zài cèdìng shuǐ lǐ yǒu duōshao sùliào hé xiānwéi zuìhòu wǒmen yòng diànnǎo yùnsuàn bǎ jiéguǒ liànghuà jiéguǒ dōu qǔ le zhěngshù yīncǐ wǒmen de shùjù shì kěyǐ jiǎnchá de · First, we sampled at different points on the river: twenty samples in all. Next, in Dr Zhou’s lab, we looked at the microbes under a microscope and measured how much plastic and fibre was in the water. Finally, we ran the numbers on a computer to quantify the results, rounded to whole numbers. So our data can be checked.

professor chen 测量都有误差。你们的误差有多大？
cèliáng dōu yǒu wùchā nǐmen de wùchā yǒu duō dà · Every measurement has error. How big is yours?

little sister 我们的仪器精度不高，误差大概是百分之五。简而言之，数据不完美，可是方向是对的。
wǒmen de yíqì jīngdù bù gāo wùchā dàgài shì bǎi fēn zhī wǔ jiǎnéryánzhī shùjù bù wánměi kěshì fāngxiàng shì duì de · Our instruments aren’t very precise, so the error is about five per cent. In short, the data isn’t perfect, but it points the right way.

professor chen 很诚实。你们遇到过什么问题？
hěn chéngshí nǐmen yùdào guo shénme wèntí · Very honest. What problems did you run into?

little sister 第一次下水，船翻了。我们检讨了很久，找到了根源：电池太高，加上风的缘故。后来我们改了设计，又去别的大学取经，少走了很多弯路。
dì yī cì xià shuǐ chuán fān le wǒmen jiǎntǎo le hěn jiǔ zhǎo dào le gēnyuán diànchí tài gāo jiāshàng fēng de yuángù hòulái wǒmen gǎi le shèjì yòu qù biéde dàxué qǔjīng shǎo zǒu le hěn duō wān lù · The first time it went in the water, it capsized. We spent a long time looking at what we’d done wrong and found the root cause: the

battery was too high, and the wind made it worse. Then we changed the design and went to learn from another university, which saved us a lot of wasted effort.

professor chen 最后一个问题：这条船对普通人有什么用？
zuìhòu yí gè wèntí zhè tiáo chuán duì pǔtōng rén yǒu shénme yòng · One last question: what use is this boat to ordinary people?

little sister 河水干不干净，关系到住在河边的人的切身利益。我们希望以后大家每天都能知道河水的情况。
hé shuǐ gān bu gānjìng guānxì dào zhù zài hé biān de rén de qièshēn lìyì wǒmen xīwàng yǐhòu dàjiā měi tiān dōu néng zhīdào hé shuǐ de qíngkuàng · Whether the river is clean matters directly to the people who live beside it. We hope that one day everyone will know the state of the river every day.

xiaoming （小声）别怕，就像上次练的那样，先走直线，再走一条曲线。
xiǎo shēng bié pà jiù xiàng shàng cì liàn de nàyàng xiān zǒu zhíxiàn zài zǒu yì tiáo qūxiàn · (quietly) Don’t be scared: just like we practised, first a straight line, then a curve.

chapter 6 the results

professor chen 下面宣布结果。本届机器人比赛的“最佳创意奖”是：小河清洁船团队！
xiàmiàn xuānbù jiéguǒ běn jiè jīqìrén bǐsài de zuìjiā chuàngyì jiǎng shì xiǎo hé qīngjié chuán tuánduì · Here are the results. This year’s “best idea” award in the robot competition goes to … the river-cleaning boat team!

little sister 真的吗？我们拿奖了！
zhēn de ma wǒmen ná jiǎng le · Really? We’ve won a prize!

professor chen 评委昨天到河边实地看过，也亲身试了你们的船。你们的数据揭示了一个问题：河的下游塑料更多。纵然还有很多问题，这条船也是一个很好的开始。今天，我们见证了它的成功。
píngwěi zuótiān dào hé biān shídì kàn guo yě qīnshēn shì le nǐmen de chuán nǐmen de shùjù jiēshì le yí gè wèntí hé de xiàyóu sùliào gèng duō zòngrán hái yǒu hěn duō wèntí zhè tiáo chuán yě shì yí gè hěn hǎo de kāishǐ jīntiān wǒmen jiànzhèng le tā de chénggōng · The judges went to the river yesterday to see for themselves and tried your boat in person. Your data reveals a problem: there’s more plastic downstream. Even if there are still many problems, this boat is a very good start. Today we have seen it succeed.

editor lin 恭喜！我想写一篇报道。这条船的来历，可以追溯到一次失败，对吧？你们的秘诀是什么？
gōngxǐ wǒ xiǎng xiě yì piān bàodào zhè tiáo chuán de láilì kěyǐ zhuīsù dào yí cì shībài duì ba nǐmen de mìjué shì shénme · Congratulations! I’d like to write a story. This boat’s story goes back to a failure, doesn’t it? What’s your secret?

little sister 没有什么秘诀。第一次失败以后，我们反省了很久。一开始我们什么都不懂，只能自己摸索；后来设法找到了好的路子：多问，多试，不放弃。
méiyǒu shénme mìjué dì yī cì shībài yǐhòu wǒmen fǎnxǐng le hěn jiǔ yì kāishǐ wǒmen shénme dōu bù dǒng zhǐ néng zìjǐ mōsuǒ hòulái shèfǎ zhǎo dào le hǎo de lùzi duō wèn duō shì bú fàngqì · There’s no secret. After the first failure we spent a long time reflecting. At first we knew nothing and had to feel our way; later we found a good approach: ask a lot, try a lot, never give up.

dr zhou 你还别说，这就是科学家最重要的东西。纵观历史，很多难题都是这样一点一点破解的。
nǐ hái biéshuō zhè jiùshì kēxué jiā zuì zhòngyào de dōngxi zòngguān lìshǐ hěn duō nántí dōu shì zhèyàng yìdiǎn yìdiǎn pòjiě de · You know what, that’s the most important thing a scientist has. Look across history, and many hard problems were cracked just like that, bit by bit.

anna 你那些计策和招数，今天全用上了！我们公司想把你们的船放在实体店里展示，让更多人看到实物。
nǐ nàxiē jìcè hé zhāoshù jīntiān quán yòng shàng le wǒmen gōngsī xiǎng bǎ nǐmen de chuán fàng zài shítǐ diàn lǐ zhǎnshì ràng gèng duō rén kàn dào shíwù · All your plans and tricks paid off today! Our company would like to display your boat in our shop, so more people can see the real thing.

xiaoming 下一步有什么点子？
xià yí bù yǒu shénme diǎnzi · So what’s the next idea?

little sister 我们要做好两手准备：一边改船，一边找更多的同学，一起探求河水的秘密。周博士，您再给我们解析一下数据，好吗？
wǒmen yào zuò hǎo liǎngshǒu zhǔnbèi yìbiān gǎi chuán yìbiān zhǎo gèng duō de tóngxué yìqǐ tànqiú hé shuǐ de mìmì Zhōubóshì nín zài gěi wǒmen jiěxī yíxià shùjù hǎo ma · We’ll get ready on two fronts: improve the boat, and find more students to explore the river’s secrets with us. Dr Zhou, could you go through our data with us again?

xiaoming 我来写个总结：首先，我们找到了问题；其次，我们找到了对策；最后，我们拿到了奖。因此，今天晚上，我请客！
wǒ lái xiě gè zǒngjié shǒuxiān wǒmen zhǎo dào le wèntí qícì wǒmen zhǎo dào le duìcè zuìhòu wǒmen ná dào le jiǎng yīncǐ jīntiān wǎnshang wǒ qǐngkè · Let me sum up: first, we found the problem; next, we found a solution; finally, we won a prize. Therefore, tonight, dinner’s on me!

little sister 简而言之：哥哥请客！
jiǎnéryánzhī gēge qǐngkè · In short: big brother’s paying!

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