NCPQ 3ed. Corrections still to be made to student book (SB) and online obook files. Richard Walding 28 July 2022.

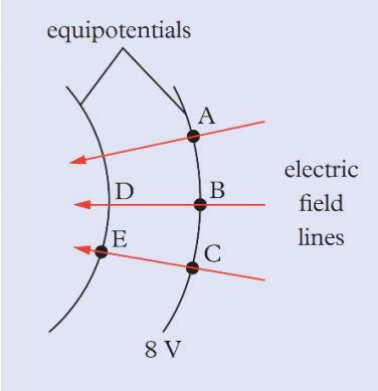
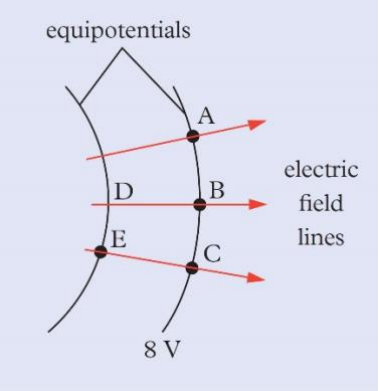
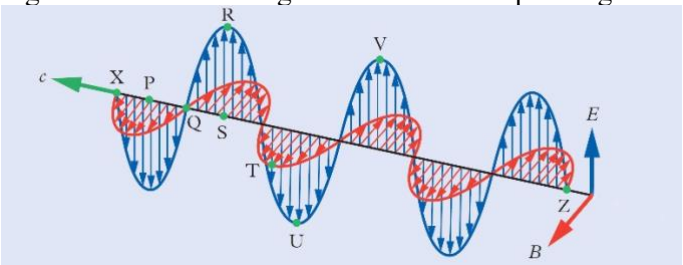
	UNIT 3&4 STUDENT BOOK
Page	Correction
SB p68 Fixed 9 Feb 2022	Chapter 2.1. The sentence at end of first paragraph "so it is called ~~the force~~ the normal force…"
SB p78 Fixed 9 Feb 2022	Chapter 2.2, worked example 2.2E. The first two questions should be swapped so that (a) vertical component…, (b) horizontal component…
SB p82 Fixed 9 Feb 2022	Chapter 2.3. Worked example 2.3B right hand side. Delete second line that says $F_{net} = ma$ $F_{net} = ma$, therefore: ~~$F_{net} = ma$~~
SB p83 Fixed 9 Feb 2022	Third line from bottom: F P should be F_P
SB p84 Added 16 June 2022	Chapter 2.3. Worked example 2.3D page 84. Delete "(tension)" in the second line. It should just read "…provide the applied force in the …"
SB p101 Fixed 9 Feb 2022	**WORKED EXAMPLE 3.2D** It is suggested that you can increase the speed of a dryer by doubling the diameter or doubling the rotational speed. Dryer A has a tub radius of 50 cm and a rotational speed of 1200 rpm, and dryer B with a diameter of 100 cm and a speed of 600 rpm. **a** Determine which dryer gives the higher speed. **b** Propose which would be preferred for a household laundry. **SOLUTION** **a** Period or revolution Dryer B: $T = \frac{1}{1200}$ minutes $= \frac{60}{1200}$ seconds $= 0.05$ s Dryer B: $T = \frac{1}{600}$ minutes $= \frac{60}{600}$ seconds $= 0.10$ s Average speed Dryer A: $v = \frac{2\pi r}{T}$ $= \frac{2\pi \times 0.50}{0.05}$ $= 62.8$ m s^{-1} Dryer B: $v = \frac{2\pi r}{T}$ $= \frac{2\pi \times 1.00}{0.10}$ $= 62.8$ m s^{-1} **b** As they both have the same velocity, the dryer with the smaller radius is preferred. It will have a greater change of velocity (centripetal acceleration) as it is moving in a smaller circle and so the change in direction will be greater in the same period of time. Thus, the clothes are being pulled away from the water with greater (centripetal) force and allowing the water to continue to move outward from the clothes.
SB p101 New correction 28 March 2022	Change **WORKED EXAMPLE 3.2D** It is suggested that you can increase the speed of a dryer by doubling the diameter or doubling the rotational speed. Dryer A has a tub radius of 50.0 cm and a rotational speed of 1200 rpm, and dryer B with a diameter of 100 cm and a speed of 600 rpm. to

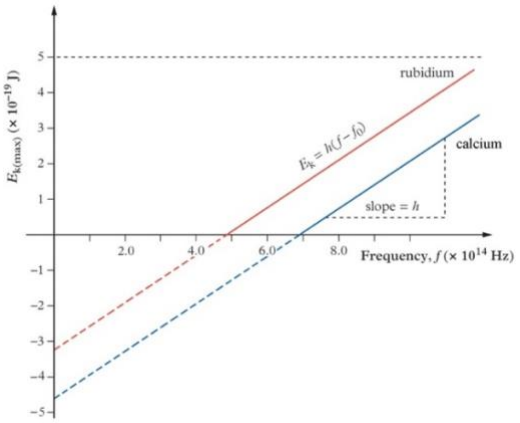
<table>
<tr><td></td><td>WORKED EXAMPLE 3.2D
It is suggested that you can increase the speed of a dryer by doubling the diameter or doubling the rotational speed. Dryer A has a tub radius of 50.0 cm and a rotational speed of 1200 rpm, and dryer B with a radius of 100 cm and a speed of 600 rpm.</td></tr>
<tr><td>SB p121
New correction
23 April 2022</td><td>Change text in explanation of Cavendish experiment:

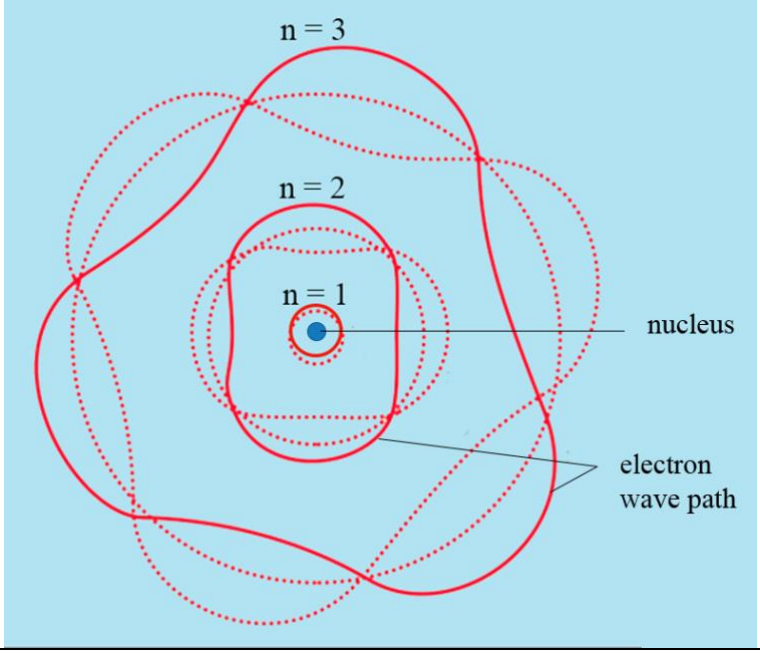
Each of the two large lead spheres used by Cavendish had a mass of 158 kg and each of the two smaller spheres had a mass ~~0.73 kg~~ 2.92 kg. Cavendish didn't actually make the apparatus he used. He inherited it from John Mitchell who died in 1793 before he could try the experiment himself.
The total force between the two pairs of lead masses was determined for various separation distances. ~~Table 1 gives the results for the total force on the fibre with the masses at various distances. These are not Cavendish's results but are derived from them.~~
The force between each pair was calculated by dividing the total force by two. Table 1 gives the results for the force on the fibre for one pair of masses (158 kg and 2.92 kg) at various distances These are not Cavendish's results but are derived from them.</td></tr>
<tr><td>SB p 122
New correction
23 April 2022</td><td>Page 122. Amend as shown below:

$= \frac{0.0306 \times 10^{-6}}{\text{~~1.46 x 316~~}\ \text{158 x 2.92}}$</td></tr>
<tr><td>SB p139
Fixed 9 Feb 2022</td><td>Replace “When referring to an elliptical orbit in general” with “When referring to an elliptical Earth orbit”</td></tr>
<tr><td>SB p146
New correction
16 July 2022</td><td>Chapter 5.3
Change “When a satellite's orbit matches the rotation of the earth, and it's position over the earth remains fixed, it's called geostationary or geosynchronous orbit.”
Correction: “When a satellite's orbit matches the rotation of the earth, it is called a geosynchronous orbit. If it's position over the earth remains fixed, it is called a geostationary orbit.”</td></tr>
<tr><td>SB p147
New correction
16 July 2022</td><td>Chapter 5.3 page 147
<table>
<tr><td>Geosynchronous Orbit

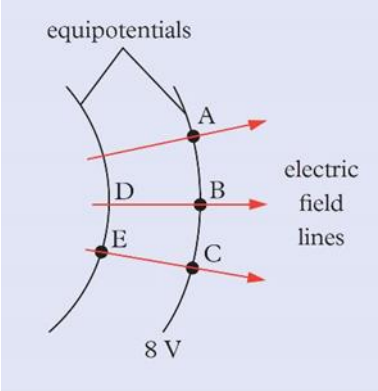
GEO</td><td>35790</td><td>24</td><td>Direct broadcast, communications relay.</td><td>Orbits once a day, but not necessarily in the same direction as the rotation of the Earth - not necessarily stationary.</td></tr>
</table>
</td></tr>
<tr><td>SB p159
Fixed 9 Feb 2022</td><td>Chapter 6. Worked example 6.1D. Change answer “44.6 N attraction” to 44.6 N repulsion”</td></tr>
<tr><td>SB p160
Fixed 9 Feb 2022</td><td>Chapter 6. Worked example 6.1E. Change “attraction” to “repulsion” in:
$F_{CA} = 3.6 \times 10^{-4}$ N attraction
$F_{CB} = 3.6 \times 10^{-4}$ N attraction</td></tr>
<tr><td>SB p161
Fixed 9 Feb 2022</td><td>Chapter 6, CYL 6.1 Q1. Change to “… to 1 significant figure, including units.”</td></tr>
<tr><td>SB p 175
Fixed 26 May 2022</td><td>Chapter 6 CYL 6.3 Q7 Figure 5. The field lines should be pointing towards the right. They should be changed from the figure on the left to the figure on the right (below):</td></tr>
</table>

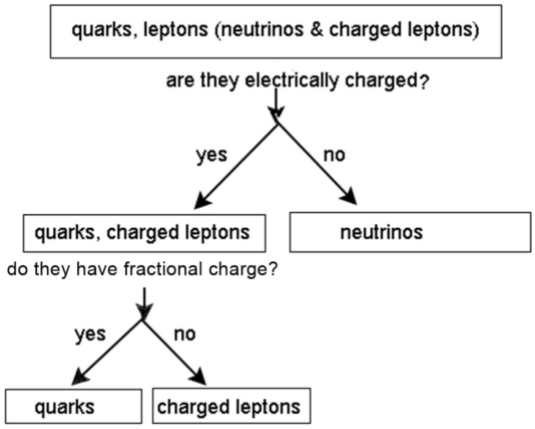
	 Incorrect  Corrected
SB p 175 Fixed 26 May 2022	Chapter 6 CYL 6.3 Q7. Change the wording of the last sentence to read: "It takes 0.2 J of work to move a +0.1C charge at point C to point E."
SB p178 Fixed 9 Feb 2022	Chapter 7, Q9. Change "A negatively charged particle is fired into an electric field **from the left** and undergoes motion as shown in Figure 6." to "A negatively charged particle is fired into an electric field **from** the **right** and undergoes motion as shown in Figure 6."
SB p 186 Fixed 9 Feb 2022	Chapter 6. Change the date in "In 1920 he published *Experiments on the effect of electricity on the magnetic needle*." to 1820.
SB p210 Fixed 9 Feb 2022	Chapter 8. Section 8.1 (half way down). Spelling "magnetic field strength = flux density"
SB p212 Fixed 9 Feb 2022	Chapter 8. Section 8.1. Corrections to text under Figure 3: "…loop (black arrow) makes with the direction of the field (red arrows)."
SB p218 Fixed 26 May 2022	Chapter 8 Worked Example 8.2C. Change last line: From: |EMF| = 0.036 V (2 To: |EMF| = 0.036 V (2 sf)
SB p231 Fixed 9 Feb 2022	Chapter 8 Electromagnetic Induction and Radiation page 231. See 5th dot point in the Summary. Delete the words in red. The oscillations are in phase ~~and of equal amplitude~~.
SB p 238 Fixed 9 Feb 2022	Chapter 8 Revision, Q 13. Delete the word "In". It should read: "Explain whether angle X or angle Y ~~In~~ represents θ."
SB p231 Fixed 9 Feb 2022	Chapter 8 Electromagnetic Induction and Radiation page 231. See 7th dot point in Summary. Delete the following words: ~~The energy associated with the electric field is equal to the energy associated with the magnetic field (represented by equal amplitudes).~~
SB p233 Fixed 9 Feb 2022	CYL 8.5 Question 1(e). Identify two points are one wavelength apart" to "Identify two points that are one wavelength apart."
SB p233	CYL 8.5 Q1 Figure should have the green arrow and 'c' pointing towards the left as shown below: 
SB p255 Fixed 9 Feb 2022	Chapter 9 Challenge 9.2B. Second last line reads "is not 1.6 c" Change to "is not 1.2c".
SB p309 Fixed 9 Feb 2022	CYL 11.3 Q1. Change to "..and the radiation from Earth ~~and~~ emitted…" (delete "and")

SB p313 New 28 Jul 2022	Chapter 11.5 p 313. Study Tip in margin. Delete 'party lights' and replace with 'UV aquarium light, or UV LED Fishing Black Torch'.
SB p318 New 28 Jul 2022	Chapter 11.5 p 318. Figure 6 caption. Change 'photon emitter' to 'photon absorber'.
SB p318 New 28 Jul 2022	Chapter 11.5 p 318. Delete second and third sentences "If incident light…on or off'. Replace with: 'If the incoming photons make the electrons more mobile without ejecting them, the conductivity of the material varies with light intensity. This is a type of photoelectric device called a photoconductor.'
SB p318 New 28 Jul 2022	Chapter 11.5 p 318. Study tip. Delete 'the photoelectric effect' and replace with 'photoelectricity'.
SB p315 Fixed 9 Feb 2022	Chapter 11 Line 5 Change "cathode to repel the ejected electrons" to "anode to repel the ejected electrons"
SB p316 Fixed 9 Feb 2022	Chapter 11 Fig 5. The x-axis scale has to be fixed. Correct figure is: 
SB p332 Fixed 9 Feb 2022	Chapter 12. Figure 4. Change to: "The hydrogen emission spectrum"
SB p334 Fixed 9 Feb 2022	Delete the last sentence on page: ~~"Bohr also proposed that within the atom only two electrons could occupy the same orbital at any one time."~~
SB p335 Fixed 9 Feb 2022	Chapter 12.2. Heading at top of page should read "**3 Angular momentum of an electron in a stationary state is quantised.**"
SB p335 Fixed 9 Feb 2022	Challenge 12.2 (a). Replace the word "Lyman" with "Balmer".
SB p336 Fixed 9 Feb 2022	Formula in shaded box in Figure 2 should be $E_n = \frac{E_1}{n^2}$
SB p337 Fixed 9 Feb 2022	Chapter 12. 4th para, 1st line. Notice that in the energy level diagram of atomic hydrogen (Figure 2),
SB p341 Fixed 9 Feb 2022	Figure 1(a). Replace existing figure with this one:

	
SB p342 Fixed 9 Feb 2022	Chapter 12. Please amend the four lines above the Worked Example 12.3D to read: where λ is the de Broglie wavelength (m), *n* is the energy level and *r* is the radius of the orbital (m). Using this formula, the wavelength of the ground state electron in hydrogen is 0.166 nm and successive energy levels will have wavelengths that are integer multiples of that value.
SB p342 Fixed 9 Feb 2022	Chapter 12 Worked Example 12.3B. Delete all words and replace with: The first three energy levels in the single-electron helium ion (n =1, 2, 3) have orbital radii of 0.026 nm, 0.106 nm and 0.238 nm respectively. Determine the wavelength of the electron standing wave for each level in nanometres. **SOLUTION** $n\lambda = 2\pi r$ $\lambda = \frac{2\pi r}{n}$ $\lambda_1 = \frac{2\pi \times 0.026\times10^{-9}}{1} = 0.166\times10^{-9}\ m\ (0.166\,nm)$ $\lambda_2 = \frac{2\pi \times 0.106\times10^{-9}}{2} = 0.332\times10^{-9}\ m\,(0.332\,nm)$ $\lambda_3 = \frac{2\pi \times 0.238\times10^{-9}}{3} = 0.500\times10^{-9}\ m\,(0.500\,nm)$
SB p356 Fixed 9 Feb 2022	Challenge 13.1B (d). Correct symbol and quark content for a double charmed Xi baryon is: $\left(\Xi_{cc}^{*+}\right): d_b c_g c_r$
SB p375 Fixed 9 Feb 2022	Ch 14.1. For the antineutron in Table 1: $B = \frac{1}{3}(0-3)$
SB p382 Fixed 9 Feb 2022	Change: composite bosons (particles made up of equal numbers of quarks and antiquarks, e.g. meson, ${}^{2}_{1}H, {}^{4}_{2}He, {}^{12}_{6}C$ and so on). In this section on Feynman diagrams you are concerned solely with gauge bosons. to: composite bosons (particles made up of equal numbers of quarks and antiquarks, e. g. meson). In this section on Feynman diagrams you are concerned solely with gauge bosons.
SB p 390 Fixed 9 Feb 2022	Change $B \rightarrow \overline{A} + B + C$ to $B \rightarrow \overline{A} + C + D$

SB p 400 Fixed 9 Feb 2022	Unit 4 Practice Exam Q3. Option B should be 9×10^{13} J
	UNIT 3&4 OBOOK
U 3&4 obook	Chapter 1 Revision Q3. Change option (D) in the online version of the questions from -9.8 m s^{-2} to -9.8^2 m s^{-2}. The online answers have this shown correctly, as does the Student Book (printed and online).
U 3&4 obook	Chapter 1 Revision Question 22 Change $s_y = u_y t + gt^2$ $u_y = -gt \left(s_y = 0\right)$ $+6.72 = +4.89\ t$ $t = 1.37$ s to $s_y = u_y t + \frac{1}{2} gt^2$ $u_y = -\frac{1}{2} gt \left(s_y = 0\right)$ $+6.72 = +4.89\ t$ $t = 1.37$ s
U 3&4 obook New correction 28 March 2022	Chapter 2, CYL2.2 Q9. Change: Friction acts as soon as motion begins. It opposes motion so if there is no motion it doesn't act. To: It is not true. The surfaces do not have to be accelerating but they have to be moving or trying to move past one another. So, whenever you try to move two objects past each other friction gets created. If there is no motion it is called 'static' friction. If they are moving (at constant speed or accelerating) it is called 'dynamic' or 'kinetic' friction.
U 3&4 obook New correction 28 March 2022	Chapter 2, CYL2.2 Q10(e). Change: $F_H = F_f$. Friction $= 86.6$ N The speed is constant, so the force is 86.6 N in the opposite direction to the motion. To: $F_f = F_H$ $= 86.6$ N (from part (b)) The speed is constant, so the frictional force is 86.6 N in the opposite direction to the motion.
U 3&4 obook New correction 28 March 2022	Chapter 4 Student book answers CYL 4.2 Q2(b) Change "One-quarter the force" to "Four times the force"
U 3&4 obook New correction 28 March 2022	Chapter 4 Student Book Answers CYL 4.3 Q 7. Error in answer. Change: $= 1.563 \times 10^7$ N kg^{-1} (towards Earth) To: = 0.613 N kg^{-1} (towards Earth)
U 3&4 obook New correction 28 March 2022	Student Book Answers, Chapter 6 CYL 6.3 Question 7. Change figure to the corrected one used in the Student Book, as shown below:

	 Needs to be fixed in Student Book Questions document as well.
U 3&4 obook New correction 28 March 2022	Student Book Answers, Chapter 6 CYL 6.3 Question 7 (b), and Q7 (c). Change spelling from "lime" to "line".
U 3&4 obook	Student Book Answers, Chapter 6 Revision Q14 **b** **Calculate** the acceleration of the particle in the field. $a = \frac{F}{m}$ $= \frac{1.6\times10^{-17}}{9.6\times10^{-26}}$ $= 1.67\times10^{8}\ \text{ms}^{-1}\ \ (1.7\times10^{8}\ \text{ms}^{-1}\ \text{to 2 sf})\ \text{down the page}$ **c** **Calculate** the time of travel of the particle in the field. $t = \frac{s}{v}$ $= \frac{0.01}{1200}$ $= 8.33\times10^{-6}\,\text{s}\,(8.3\times10^{-6}\,\text{s to 2sf})$ **d** **Calculate** the final displacement and velocity in the direction of the field. $s_y = u_y t + \frac{1}{2}\times a\times t^2$ $s_y = 0 + \frac{1}{2}\times1.67\times10^{8}\times(8.33\times10^{-6})^2$ $= 5.79\times10^{-3}\,\text{m}\,(5.8\times10^{-3}\,\text{m to 2sf})$ $v_y = u_y + at$ $= 0 + 1.67\times10^{8}\times8.33\times10^{-6}$ $= 1391\,\text{ms}^{-1}\,(1400\,\text{ms}^{-1}\,\text{to 2sf})$ *OR* $v_y^{\,2} = u_y^{\,2} + 2as_y$ $= 0 + 2\times1.67\times10^{8}\times5.8\times10^{-3}$ $v_y = \sqrt{2\times1.67\times10^{8}\times5.8\times10^{-3}}$ $= 1392\,\text{ms}^{-1}\,(1400\,\text{ms}^{-1}\,\text{to 2sf})$ **e** **Describe** the probable path of the particle in the field.

	The charge will move in a curved path from the top left to bottom right in the field.
U 3&4 obook	Chapter 10 Review Q15. Answer should be: $\Delta E = \Delta mc^2$ $= 1.0\times10^{-6}\times(3\times10^{8})^2$ $= 9.0\times10^{-10}\,\text{J (to 2 sf)}$
U 3&4 obook	Chapter 11.5 Practical worksheet answers. Threshold frequency column should have the exponent in the second row as 10^{14} NOT 1014
U3&4 obook Added 16 June 2022	Chapter 13.1, CYL 13.1 Q10. The answer should read: The conditions are that they must have the same mass but opposite charge. Explanation (optional): a particle and its antiparticle cannot be identical as the antiparticle must have the opposite charge to its corresponding particle. However, if the particle is uncharged, such as a photon or neutrino, then the particle and antiparticle are considered the same thing. [Note that the syllabus has the definition of an antiparticle incorrect. It says that an antiparticle is "a particle with the same mass and opposite charge and/or spin as a corresponding particle". However, while it has to have the opposite charge, it doesn't necessarily have to have the opposite spin. Besides, 'spin' is not a syllabus term that you have to know anyway.]
U 3&4 obook	Chapter 13 Student book answers, CYL 13.2 Q6 
U 3&4 obook	Unit 4 Practice exam answers. Q2. Answer is (A) not (B).
U 3&4 obook	Unit 4 Practice exam answers. Q14. **a** Determine the work function of the metal. $E_k = hf - W$ $\frac{1}{2}mv^2 = \frac{hc}{\lambda} - W$ $W = \frac{hc}{\lambda} - \frac{1}{2}mv^2$ $W = \frac{6.624\times10^{-34}\times3\times10^{8}}{310\times10^{-9}} - \frac{1}{2}\times9.11\times10^{-31}\times(0.0024\times3\times10^{8})^2$ $= 6.410\times10^{-19} - 2.361\times10^{-19}$ $W = 4.049\times10^{-19}\,\text{J}\,(4.0\times10^{-19}\,\text{J to 2 sf})$ Check if answer is reasonable. Work function of most metals is in the range of about 1 to 5 eV.

	$W = 4.049\times10^{-19}\ \text{J}$ $= \dfrac{4.049\times10^{-19}\ \text{J}}{1.60\times10^{-19}\ \text{J/ eV}}$ $= 2.53\,\text{eV (reasonable)}$
U 3&4 obook	Assess Quizzes Chapter 2 Support Q10. Add degree symbol after the 30
U 3&4 obook	Assess Quizzes Chapter 3 Extend Q5 Question should read: Determine what distance the coin should be placed from the centre so at the new velocity the coin will just begin to slip. [correct answer] 32 cm [incorrect answer] 2 cm [incorrect answer] 16 cm [incorrect answer] 24 cm
U 3&4 obook	Chapter 1 Support Q8. The option "6.0 s" should be "6.1 s".
U 3&4 obook	Chapter 1 Consolidate Q3. The values in the four options should be: 29, 180, 34, 20. The answer of 20 m s^{-1} is still correct.
U 3&4 obook	Chapter 11 Support Q8 Change "Which of the phenomena can be verified by firing electrons at a metal…" to "Which of the phenomena can be verified by shining light on a metal…"
U 3&4 obook	U3&4 Assess Quizzes Chapter 11 Support Q1. Change "fundamental" to "elementary"
U 3&4 obook	U3&4 Assess Quizzes Chapter 14 Consolidate Q4. Please note: the option that says: $2\Xi^0 \rightarrow \Omega^-$ should read $\Xi^0 \rightarrow \Omega^-$. The question should read: Which one of the following reactions does not obey the law of baryon conservation? $\Omega^- + \Xi^0 \rightarrow \text{K}^-$ [correct] $\Xi^0 \rightarrow \Omega^- + \text{K}^-$ $\Xi^0 \rightarrow \Omega^-$ $\Omega^- \rightarrow \Xi^0 + \text{K}^-$