Covering teacher guide

Energy stores and changes in systems

Start here / subject briefing

Before this lesson: Consolidation after pupils have met energy stores and transfers. No calculations, pupil devices or practical apparatus are required today.

An energy store belongs to an object or a chosen group of objects, called a system. A pathway describes how energy is transferred. Compare the same start and finish: movement during a journey does not mean the object finishes with more kinetic energy. Energy is conserved while stores change.

Words and symbols you will need

Term	Plain-English meaning
Kinetic	The store associated with a moving object.
Chemical	The store in a battery, fuel or food.
Thermal / internal	The store that increases when an object warms and decreases when it cools here.
Gravitational potential	The store of an object and the Earth that increases when the object is raised.
Elastic potential	The store associated with stretching or compressing an object.
Transfer pathway	Mechanically: a force does work. Electrically: charge flows through a potential difference. Heating: hotter to cooler. Radiation: e.g. light.

Help pupils choose a method

1. Name the object and store that decrease, then the object and store that increase.
2. Describe the transfer pathway between the objects. “Electrical”, “heat” and “light” are not extra stores.
3. Compare the stated endpoints. At rest, the kinetic energy is zero, even after a journey.

Use the supplied model - pupil page 2

Use the heater model on pupil page 2. Ask which objects are included: energy enters the heater electrically, but enters the water by heating from the hotter element.

The battery's chemical store decreases. Energy is transferred electrically to the heating element. The hotter element transfers energy by heating to the water, increasing the water's thermal/internal store. For water alone the incoming pathway is heating; for the heater device the supply enters electrically.

If pupils are still stuck

Read the matching coaching and direct the named retry within its replacement time. Help the pupil start an object-store-change sentence. If the retry is still insecure, record the specific missing store or pathway and return the booklet to the usual teacher.

Turn to teacher page 2 for the timed run sheet. Keep this guide separate from the pupil booklet.

Run the lesson from this page

Energy stores and changes in systems

Download and print one complete 6-page pupil handout per pupil, in order. Double-sided printing is fine; staple each booklet.

Read the subject briefing on teacher page 1. Use the timed run sheet on page 2 and the numbered answers. Each check has Say / Ask / Expect coaching and a fresh retry.

Pupils need a pen and a different-coloured pen. All reading and questions are included; no pupil accounts, devices or apparatus are needed.

Min	Pupil page / Q	Read aloud / check	Next action and answer key
0-5	1 / 1-3	“Start on page 1. Work from memory.” At 5 minutes check the three answers.	If insecure, Try again A on page 1 in the first 2 reading minutes; otherwise page 2. Answers: teacher page 3. Coaching: page 7.
5-15	2 / reading	“Read the rules and follow the model. You can use this page during practice.”	Check Try again A, if used. Do not add it to the lesson time.
15-20	3 / 4	“Choose an answer and write your reasons. Stop at the check.”	Check C and both store directions. If insecure, Try again B on page 3 replaces 8-9. Answers: teacher page 3. Coaching: page 8.
20-30	3-4 / 5-9	“Work through questions 5-9. Show working clearly.”	If Try again B was used, leave 8-9 blank. Check the retry before continuing. Answers: teacher page 4.
30-33	4 / 10	“Pause the practice. Answer question 10 independently.”	If insecure, Try again C on page 4 replaces 11-12. Otherwise continue. Answers: teacher page 4. Coaching: page 9.
33-45	5 / 11-14	“Continue the practice. Use page 2 if you need a rule.”	Check support responses promptly. If finished early, improve the explanation in question 14. Answers: teacher page 5.
45-55	5 / 15	“Check your practice in a different colour, then explain one correction.”	Read the practice answers from this guide. Keep the exit answer hidden. Answers: teacher page 5.
55-60	6 / 16	“Cover the earlier pages. Complete the final question on your own.”	Collect every booklet. Check the exit afterwards; record any Try again D follow-up. Answers: teacher page 6. Coaching: page 10.

The run sheet totals 60 minutes. Try again A uses reading time; B and C replace named practice questions; D is next lesson only. Timings are estimates, not classroom-trial results.

Checks 1 and 2: pages 1 and 3

Match the pupil number. Accept equivalent correct wording. Keep this guide separate from pupils.

1. (pupil p1) The scooter's kinetic energy store.

2. (pupil p1) The battery's chemical energy store.

3. (pupil p1) The water's thermal/internal energy store. Heating is a transfer, not a separate store.

4. (pupil p3) C. The gravitational potential store of the book-Earth system decreases as height decreases. The book's kinetic store increases as its speed increases.

Try again A - pupil page 1

Only if your teacher asks. Use the first 2 minutes of reading time, then turn to page 2.

(a) The wheel's kinetic store. (b) The water's thermal/internal store.

Try again B - pupil page 3

Only if your teacher asks. Complete this instead of questions 8 and 9. Then answer questions 5-7.

The trolley's kinetic store decreases; the gravitational potential store of the trolley-Earth system increases.

Practice: pages 3 and 4

Match the pupil number. Accept equivalent correct wording. Keep this guide separate from pupils.

5. (pupil p3) The gravitational potential store of the load-Earth system increases.

6. (pupil p3) The thermal/internal energy store of the water increases.

7. (pupil p3) The trolley's kinetic store increases; the battery's chemical store decreases. Electrical describes a transfer pathway, not a store.

8. (pupil p4) Mechanically: a force does work on the load.

9. (pupil p4) The load finishes at rest, so its kinetic energy is zero. Its gravitational potential store has increased by 600 J because it is at a greater height.

10. (pupil p4) The spring's elastic potential store decreases and the cart's kinetic store increases. The spring transfers energy mechanically by doing work on the cart.

Try again C - pupil page 4

Only if your teacher asks. Complete this instead of questions 11 and 12. Then continue with the other questions.

The rubber band's elastic potential store decreases and the glider's kinetic store increases. Transfer is mechanical, as the band does work on the glider.

Practice and review: page 5

Match the pupil number. Accept equivalent correct wording. Keep this guide separate from pupils.

11. (pupil p5) Electrically.

12. (pupil p5) The trolley's kinetic store decreases. Work is done against friction. Thermal/internal stores of the brakes, wheels and surroundings increase.

13. (pupil p5) Energy is transferred electrically from the mains to the heater, then by heating from the hotter heater to the water. The water's thermal/internal store increases.

14. (pupil p5) The water's thermal/internal store decreases. Energy is transferred by heating to the cooler surroundings, increasing their thermal/internal store.

15. (pupil p5) Accept an accurate correction that names the error and explains the better physics. For question 7, the trolley's kinetic store increases and the battery's chemical store decreases. Electrical describes transfer to the motor, not an extra store. For the all-correct option, explain the same distinction between energy associated with an object and the way energy is transferred.

Exit and next lesson: page 6

Match the pupil number. Accept equivalent correct wording. Keep this guide separate from pupils.

16. (pupil p6) (a) The battery's chemical store decreases and the gravitational potential store of the robot-Earth system increases. (b) The robot is at rest at both endpoints, so its kinetic energy is zero at both. Movement during the journey does not imply a final kinetic-store increase. (c) Energy is transferred electrically from the battery to the motor.

Try again D - next lesson - pupil page 6

Leave this today. Your usual teacher may ask you to do it next lesson.

Chemical decreases; gravitational potential increases; final kinetic energy is zero because the load is stationary; the battery transfers energy electrically to the motor.

Collect and follow up

Collect the whole named booklet. Check the independent exit against the key, record which learning objectives are secure, and tell the usual teacher which pupils need Try again D next lesson.

Source provenance - for the usual teacher

Pupil question	Original worksheet part / page
5	WS-45 Q1(a) / source p1
6	WS-45 Q1(b) / source p1
7	WS-45 Q1(c) / source p1
8	WS-45 Q2(c) / source p2
9	WS-45 Q2(d) / source p2
11	WS-45 Q3(a) / source p3
12	WS-45 Q3(e) / source p3
13	WS-45 Q4(a) / source p4
14	WS-45 Q4(c) / source p4

Selected practice is reformatted from the maintained PhysicsUK worksheet. Required context is included; unassigned parts are omitted.

Source worksheet | Maintained solutions | Revision notes

Check 1: Entry

Question 1, Question 2, Question 3

Look for: Use kinetic, chemical and thermal/internal as store names, attached to the relevant objects.

If secure: Turn to the reading and models on pupil page 2.

If: question 1 or question 2 names movement, electricity or power as a store.

Likely issue: The pupil has not distinguished a store from an observation, pathway or rate.

Say: Use a store name attached to an object. Movement goes with a kinetic store; a battery has a chemical store. Electrical describes a transfer. Power is energy transferred per second.

Ask: Name the scooter's movement store and the charged battery's store in questions 1-2.

Expect: Scooter: kinetic. Battery: chemical. "Movement", "electricity" or "power" alone does not name the required store.

Next: Use pupil page 2, store table: kinetic and chemical, and Four transfer pathways. Then ask pupils to attempt Try again A independently on pupil page 1. Use the first 2 reading minutes. Check the fresh response against the numbered answer key.

pupil page 2, store table: kinetic and chemical, and Four transfer pathways; Try again box on pupil page 1; online #concept-1.

If: question 3 calls the store heat or says cold enters the water.

Likely issue: Stored internal energy is being confused with heating or cold as a substance.

Say: The hot water transfers energy to cooler surroundings by heating. Its thermal/internal store decreases. Cold does not flow into it as a substance.

Ask: Which object's store decreases as the water cools, and what is that store called?

Expect: The water's thermal/internal store decreases. Heating describes the transfer, not an extra store called heat.

Next: Use pupil page 2, thermal/internal row and the heating definition. Then ask pupils to attempt Try again A independently on pupil page 1. Use the first 2 reading minutes. Check the fresh response against the numbered answer key.

pupil page 2, thermal/internal row and the heating definition; Try again box on pupil page 1; online #concept-1.

If the retry remains insecure, use the support guidance on teacher page 1 and record the precise difficulty for the usual teacher.

Check 2: Hinge

Question 4

Look for: C with a reason linking falling height to less gravitational potential and increasing speed to more kinetic energy.

If secure: Start questions 5-9. Require the explanation as well as the correct choice.

If: A, or a correct letter with the directions reversed in the explanation.

Likely issue: The direction of each store change is insecure.

Say: During the fall before impact, the book gets lower and faster. Lower height means less gravitational potential energy; greater speed means more kinetic energy.

Ask: As the book falls in question 4, what happens to its height and speed? Link each to a store change.

Expect: Height decreases, so gravitational potential decreases. Speed increases, so kinetic increases. Option C.

Next: Use height-and-speed help in Try again B, pupil page 3. Then ask pupils to attempt Try again B independently on pupil page 3. This replaces questions 8-9. Then continue with questions 5-7. Check the fresh response against the numbered answer key.

height-and-speed help in Try again B, pupil page 3; Try again box on pupil page 3; online #concept-2.

If: B.

Likely issue: The pupil assumes all movement needs a chemical store to decrease.

Say: Movement does not always need a battery or fuel. This falling book is not powered by a chemical store; its decreasing height supplies the relevant energy change.

Ask: Which store decreases because the book is getting lower?

Expect: The gravitational potential store of the book-Earth system, not a chemical store.

Next: Use height-and-speed help in Try again B, pupil page 3. Then ask pupils to attempt Try again B independently on pupil page 3. This replaces questions 8-9. Then continue with questions 5-7. Check the fresh response against the numbered answer key.

height-and-speed help in Try again B, pupil page 3; Try again box on pupil page 3; online #concept-2.

If: D.

Likely issue: A transfer such as light is being treated as an energy store.

Say: Light is radiation: a possible transfer pathway, not an energy store. In the stated fall, the increasing speed identifies the store that increases.

Ask: Which energy store increases when the book speeds up?

Expect: The book’s kinetic store. There is no separate light store.

Next: Use height-and-speed help in Try again B, pupil page 3. Then ask pupils to attempt Try again B independently on pupil page 3. This replaces questions 8-9. Then continue with questions 5-7. Check the fresh response against the numbered answer key.

height-and-speed help in Try again B, pupil page 3; Try again box on pupil page 3; online #concept-2.

If the retry remains insecure, use the support guidance on teacher page 1 and record the precise difficulty for the usual teacher.

Check 3: Mid Practice

Question 10

Look for: Elastic potential decreases, kinetic increases, with mechanical transfer while the spring pushes.

If secure: Continue with questions 11-14 on page 5.

If: Chemical or electrical is given as the starting spring store.

Likely issue: The pupil is applying the battery example to every device.

Say: A compressed spring has an elastic potential store. As it pushes the cart and relaxes, that store decreases while the moving cart's kinetic store increases.

Ask: In question 10, name the object and store that decrease, then the object and store that increase.

Expect: Spring: elastic potential decreases. Cart: kinetic increases. The spring is not a battery or fuel.

Next: Use pupil page 2, elastic potential row and the mechanical pathway. Then ask pupils to attempt Try again C independently on pupil page 4. This replaces questions 11-12. Continue with the other practice questions. Check the fresh response against the numbered answer key.

pupil page 2, elastic potential row and the mechanical pathway; Try again box on pupil page 4; online #concept-1.

If: Stores are correct but mechanical is called a store, or the pathway is omitted.

Likely issue: Store names and transfer language are not yet separated.

Say: The spring exerts a pushing force and does work on the cart. "Mechanically" describes how energy is transferred; it is not a store in the cart.

Ask: How does the pushing spring transfer energy, and which cart store increases?

Expect: Mechanically, by doing work; the cart's kinetic store increases.

Next: Use pupil page 2, store/pathway distinction and the mechanical pathway. Then ask pupils to attempt Try again C independently on pupil page 4. This replaces questions 11-12. Continue with the other practice questions. Check the fresh response against the numbered answer key.

pupil page 2, store/pathway distinction and the mechanical pathway; Try again box on pupil page 4; online #concept-1.

If the retry remains insecure, use the support guidance on teacher page 1 and record the precise difficulty for the usual teacher.

Check 4: Exit

Question 16

Look for: Name chemical and gravitational potential correctly, compare stationary endpoints, and identify electrical transfer.

If secure: Record the objectives demonstrated. If insecure, use Try again D next lesson after revisiting the named reading.

If: The answer says kinetic increased because the robot moved, despite finishing at rest.

Likely issue: Motion during a process is being confused with the chosen final state.

Say: Compare the stated start and finish, not the journey in between. The robot is at rest at both endpoints, so its kinetic energy is zero at both.

Ask: What is the robot's speed at the start and at the finish in question 16?

Expect: Zero at both. Its final kinetic energy is not greater, even though it moved during the journey.

Next: Next lesson, first use pupil page 2, Compare the start and the finish. Then ask pupils to attempt Try again D independently on pupil page 6. This is outside today's 60 minutes. Check the fresh response against the numbered answer key.

pupil page 2, Compare the start and the finish; Try again box on pupil page 6; online #concept-3.

If: Electrical is called the battery store, or the increased gravitational potential store is missing.

Likely issue: Source store, destination store and pathway remain insecure.

Say: The battery's chemical store decreases. Energy is transferred electrically to the motor. Ending higher increases the gravitational potential store of the robot and Earth.

Ask: Name the decreasing battery store, the store greater at the end and the battery-to-motor pathway.

Expect: Chemical decreases; gravitational potential increases; the battery-to-motor transfer is electrical. Electrical is not a store.

Next: Next lesson, first use pupil page 2, chemical and gravitational potential rows; the heater model's electrical pathway. Then ask pupils to attempt Try again D independently on pupil page 6. This is outside today's 60 minutes. Check the fresh response against the numbered answer key.

pupil page 2, chemical and gravitational potential rows; the heater model's electrical pathway; Try again box on pupil page 6; online #concept-1.

If the retry remains insecure, use the support guidance on teacher page 1 and record the precise difficulty for the usual teacher.

Specification and review

AQA 8463: 4.1.1.1 | AQA 8464: 6.1.1.1. Qualitative store changes and transfer pathways within these specification points. Both courses and tiers use the same selection. No energy-equation calculations are assigned.

PhysicsUK original cover lesson. Reviewed 2026-10-31. Timings estimated.