hachette LEARNING

Physics review

www.hachettelearning.com/physicsreview

Volume 35, Number 4, April 2026

Activity

Practice exam questions

Simon Carson

Use the questions below either in class or for individual work after students have read the articles in the magazine. Although the questions state the values of constants required, some of the questions require additional data – students should either make reasonable estimates of quantities or look up values using a data book or website. Students should clearly communicate any assumptions made. Suggested outline answers to questions are provided in a separate document.

The acoustics of the Royal Albert Hall

1 A lecture theatre has a volume of 600 m^3. When empty, its reverberation time is measured to be 2.40 s.

Use Sabine's formula to calculate the total acoustic absorption, $S\alpha$, of the empty lecture theatre. Sabine's formula is:

$$T_{60} = 0.161 \frac{V}{S\alpha},$$

where T_{60} is the reverberation time in seconds

0.161 is an empirical constant with units of seconds $metre^{-1}$

V is the volume of the lecture theatre in $metres^3$

$S\alpha$ is the total acoustic absorption in $metres^2$ (or m^2 sabins).

2 The lecture theatre is then filled with students, which increases the total acoustic absorption to 80 m^2 sabins.

Calculate the new reverberation time of the lecture theatre when it is occupied.

3 During a lecture, a loudspeaker produces a sound intensity of 2.0×10^{-6} W m^{-2} at a particular point in the theatre.

Using a reference intensity of 1.0×10^{-12} W m^{-2}, calculate the sound level at this point in decibels (dB).

4 Explain why increasing the acoustic absorption of a lecture theatre can improve speech intelligibility, even though the sound level from the loudspeaker may decrease slightly.

Power from wind turbines

1 A horizontal-axis wind turbine has blades of radius 40.0 m. The density of air is:

ρ = 1.20 kg m^{-3}

The power available in the wind is given by:

$P_{wind} = ½ \rho \pi R^2 v^3$

© Hodder & Stoughton Limited 2026

a Show that the area swept out by the blades is approximately 5.0×10^3 m^2.

b When the wind speed is 10.0 m s^{-1}, calculate the power available in the wind.

2 In practice, the power output of the turbine is given by:

$P_{turbine} = C_p P_{wind}$

where C_p is the power coefficient.

The turbine has a power coefficient of $C_p = 0.400$. Calculate the electrical power output of the turbine at this wind speed.

3 The Betz limit states that the maximum possible value of the power coefficient for a wind turbine is $C_p = 0.593$.

a Calculate the maximum possible power output of this turbine at a wind speed of 10 m s^{-1}.

b Explain why the power coefficient of a real wind turbine must always be less than the Betz limit.

4 The wind speed later increases to 12.0 m s^{-1}.

a Calculate the new power available in the wind and determine the factor by which the power available in the wind has increased.

b Comment on how this change in wind speed would affect the power output of the turbine, assuming the same value of C_p.

Dishwasher physics

A dishwasher is used to wash both plastic containers and ceramic plates. After the final hot rinse, both types of crockery are at a temperature of 70°C.

The dishwasher is then switched off and the door remains closed while the items cool and dry.

Use the following data to answer the questions.

Material	Specific heat capacity / J kg^{-1}K^{-1}
Plastic	1670
Ceramic	900

1 Assume both a plastic container and a ceramic plate of similar dimensions have the same mass of 0.50 kg.

a Calculate the thermal energy stored in each item due to its temperature above the room temperature of 20°C at the end of the wash cycle.

b State which item stores more thermal energy and explain why.

2 During the drying stage, the stored thermal energy causes the evaporation of water from the surfaces of the crockery.

Explain which item will dry faster in the dishwasher.

© Hodder & Stoughton Limited 2026

3 In practice, plastic items are usually much lighter than similar ceramic items.

Suppose the plastic item has a mass of 0.030 kg. How would this change your answers?

4 Suggest one design feature used in modern dishwashers that helps plastic items to dry more effectively, and explain how it improves drying.

This resource is part of PHYSICS REVIEW, a magazine written for A-level students by subject experts. To subscribe to the full magazine, go to www.hachettelearning.com/physicsreview