A Dictionary of
Physics

SIXTH EDITION

[illegible] LIBRARY

OXFORD
UNIVERSITY PRESS

APPLE 1034
Apple v. Smith Interface
IPR2024-01087

REF
530.03
DIC
2009, 6th ed.

OXFORD
UNIVERSITY PRESS
Great Clarendon Street, Oxford OX2 6DP

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide in

Oxford New York
Auckland Cape Town Dar es Salaam Hong Kong Karachi
Kuala Lumpur Madrid Melbourne Mexico City Nairobi
New Delhi Shanghai Taipei Toronto

With offices in
Argentina Austria Brazil Chile Czech Republic France Greece
Guatemala Hungary Italy Japan Poland Portugal Singapore
South Korea Switzerland Thailand Turkey Ukraine Vietnam

Oxford is a registered trade mark of Oxford University Press
in the UK and in certain other countries

Published in the United States
by Oxford University Press Inc., New York

© Market House Books Ltd, 1985, 1990, 1996, 2000, 2003, 2005, 2009

The moral rights of the author have been asserted
Database right Oxford University Press (maker)

First edition 1985 as *Concise Dictionary of Physics*
Second edition 1990
Third edition 1996
Fourth edition 2000 retitled *Dictionary of Physics*
Fifth edition 2005
Sixth edition 2009

All rights reserved. No part of this publication may be reproduced,
stored in a retrieval system, or transmitted in any form or by any means,
without the prior permission in writing of Oxford University Press,
or as expressly permitted by law, or under terms agreed with the appropriate
reprographics rights organization. Enquiries concerning reproduction
outside the scope of the above should be sent to the Rights Department,
Oxford University Press, at the address above

You must not circulate this book in any other binding or cover
and you must impose this same condition on any acquirer

British Library Cataloguing in Publication Data
Data available

Library of Congress Cataloging in Publication Data
Data available

Typeset by Market House Books Ltd.
Printed in Great Britain by
Clays Ltd, St Ives plc

ISBN 978-0-19-923399-1

10 9 8 7 6 5 4 3 2 1

explosion in 1952. Microgram quantities of the element did not become available until 1961.

Einstein–Podolśky–Rosen experiment *See* EPR EXPERIMENT.

Einstein shift *See* REDSHIFT.

Einstein theory of specific heat A theory of the specific heat of solids proposed by Albert Einstein in 1906. In this theory, Einstein attributed the specific heat of solids to the vibrations of the solid and made the simplifying assumption that all the vibrations have the same frequency. This theory was partially successful since it was able to derive *Dulong and Petit's law at high temperatures and showed that the specific heat capacity goes to zero as the absolute temperature also goes to zero. A better description of the specific heat of solids was given by the more realistic *Debye theory of specific heat.

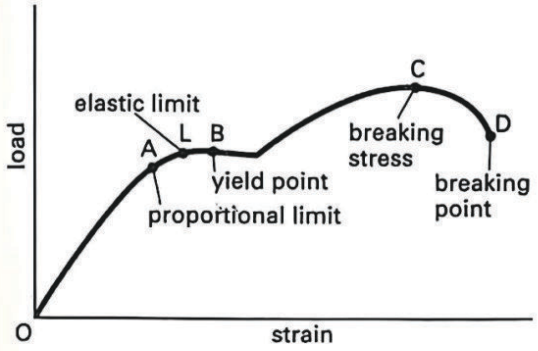
ekpyrotic universe A model of the universe that postulates that the big bang occured because of the collision of two parallel branes of a type predicted to occur in string theory (*see* BRANE WORLD) . The term 'ekpyrotic' means 'coming out of fire'. It has been developed into a **cyclic model** of the universe, which avoids the problems of entropy associated with the *oscillatory universe. There are some differences between the predictions of the ekpyrotic theory and those of the the more established *inflationary universe.

elastance The reciprocal of *capacitance. It is measured in farad^{-1} (sometimes called a 'daraf').

elastic collision A collision in which the total kinetic energy of the colliding bodies after collision is equal to their total kinetic energy before collision. Elastic collisions occur only if there is no conversion of kinetic energy into other forms, as in the collision of atoms. In the case of macroscopic bodies this will not be the case as some of the energy will become heat. In a collision between polyatomic molecules, some kinetic energy may be converted into vibrational and rotational energy of the molecules, but otherwise molecular collisions appear to be elastic.

elasticity The property of certain materials that enables them to return to their original dimensions after an applied *stress has been removed. In general, if a stress is applied to a wire, the *strain will increase in proportion (see OA on the illustration) until a certain point called the **limit of proportionality** is reached. This is in accordance with *Hooke's law. Thereafter there is at first a slight increase in strain with increased load until a point L is reached. This is the **elastic limit**; up to this point the deformation of the specimen is elastic, i.e. when the stress is removed the specimen returns to its original length. Beyond the point L there is permanent deformation when the stress is removed, i.e. the material has ceased to be **elastic** and has become **plastic**. In the plastic stages individual materials vary somewhat; in general, however, at a point B there is a sudden increase in strain with further

increases of stress – this is the **yield point**. Beyond the point C, the **breaking stress**, the wire will snap (which occurs at point D).



Elasticity.

elastic modulus The ratio of the *stress applied to a body to the *strain produced. The **Young modulus of elasticity**, named after the British physicist Thomas *Young, refers to longitudinal stress and strain. The **bulk modulus** is the ratio of the pressure on a body to its fractional decrease in volume. The **shear** (or **rigidity**) **modulus** is the tangential force per unit area divided by the angular deformation in radians.

electret A permanently electrified substance or body that has opposite charges at its extremities. They resemble permanent magnets in many ways. An electret can be made by cooling certain waxes in a strong electric field.

electrical conductivity in metals See Feature (pp 146–147).

electrical energy A form of energy related to the position of an electric charge in an electric field. For a body with charge Q and an electric potential V, its electrical energy is QV. If V is a potential difference, the same expression gives the energy transformed when the charge moves through the p.d.

electric arc A luminous discharge between two electrodes. The discharge raises the electrodes to incandescence, the resulting thermal ionization largely providing the carriers to maintain the high current between the electrodes.

electric-arc furnace A furnace used in melting metals to make alloys, especially in steel manufacture, in which the heat source is an electric arc. In the direct-arc furnace, such as the Héroult furnace, an arc is formed between the metal and an electrode. In the indirect-arc furnace, such as the Stassano furnace, the arc is formed between two electrodes and the heat is radiated onto the metal.

electric bell A device in which an electromagnetically operated hammer strikes a bell (see illustration). Pressing the bell-push closes a circuit, causing current to flow from a battery or mains step-down transformer through an electromagnet. The electromagnet attracts a piece of soft iron attached to the hammer, which strikes the bell and at the same time breaks the circuit. The