

PDF MTG PHYSICS FOR YOU MARCH 2020

► Physics at work: Sport



In many games, a ball is thrown or hit. The ball does not travel in a straight line, but in a **parabolic** trajectory. (This is because gravity is pulling it downwards.) To be more accurate, it is the centre of gravity of the ball that follows the parabola.



The centre of gravity (centre of mass) of a person is usually behind the navel, but it depends on the positions of the arms and legs. When an acrobat or a diver jumps through the air, the centre of gravity moves in a smooth parabola, no matter how the person twists or spins.



The gymnast must keep her centre of mass directly over her hands, in order to balance.

In judo it's an advantage to have a low centre of mass, and stand with your legs apart, for stability.

Skiing is another sport where a low centre of mass is helpful.

Can you think of any others?



PHYSICS FOR YOU MARCH 2020

It has been fully revised and updated for the new A Level specifications for first teaching from September 2020, and is suitable for AQA, OCR, WJEC and Edexcel. The textbook provides plenty of examples and practice questions for consolidation of learning. Additional sections in the textbook provide help with revision and exam technique, practical skills and maths skills.

MOMENTUM MOMENTUM

The **momentum** of an object depends on its **mass** and its **velocity**.

In fact:

$$\text{Momentum} = \text{mass} \times \text{velocity}$$

(kg) (m/s)

or $\text{Momentum} = mv$



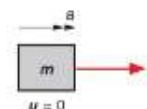
Momentum is a **vector** quantity. It is measured in units of **kg m/s**.

A bicycle of mass 10 kg moving at 5 m/s has a momentum of 50 kg m/s.

Consider a force **F** acting on a mass **m** for a time **t** so that it accelerates from velocity **u** to velocity **v**.

From page 131, acceleration $a = \frac{v - u}{t}$

∴ Newton's Second Law (page 134) is: $F = ma = m\left(\frac{v - u}{t}\right) = \frac{mv - mu}{t}$



or in words: $\text{Force (N)} = \frac{\text{change in momentum (kg m/s)}}{\text{time taken for the change (s)}} = \frac{\text{momentum after} - \text{momentum before}}{\text{time taken for the change}}$

or, multiplying both sides by time, we get: **Force × time = change in momentum**

Example 1

Consider first a boy kicking a **stone** of mass 1 kg and accelerating it from rest to 10 m/s. Because the stone is rigid, the force of his foot acts for only $\frac{1}{100}$ second. Calculate this force.

Formula first: $\text{Force} = \frac{\text{momentum after} - \text{momentum before}}{\text{time taken}}$



Class 11

NEET | JEE Essentials: Thermodynamic & kinetic Theory

Ace Your Way CBSE : Series 7 : Oscillation | Waves

MPP-9: Heat and Thermodynamics

Brain Map: Motion of Rigid Body

Covering all GCSE specifications, this tried and tested series has been fully updated to match the (9-1) GCSE Physics specifications for first examination in 2020, as well as international specifications. With a focus on science, concepts develop naturally, engaging students and enabling them to get a thorough understanding of Physics.

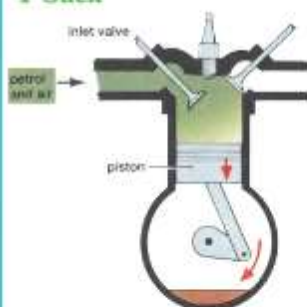
► Physics at work: Heat engines

4-stroke petrol engine

A car or motor-bike uses an *internal combustion engine*. In a petrol engine, the petrol vapour is squeezed and then exploded. The chemical energy of the fuel and air is transferred to kinetic energy (and thermal energy). However it is only about 25% efficient. The 4 steps are:



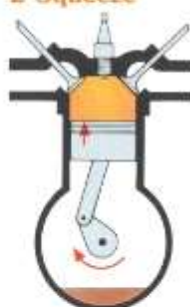
1 Suck



Induction stroke

The inlet valve is open and the piston is moving down. A mixture of petrol vapour and air is sucked in (or injected under pressure).

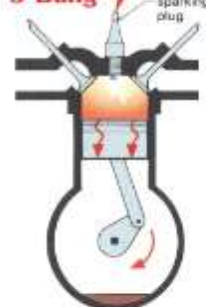
2 Squeeze



Compression stroke

The valves close and the piston moves up to squeeze the mixture of petrol and air to about 1/8th of its original volume. So it gets hotter.

3 Bang



Power stroke

An electric spark from the sparking plug ignites the mixture which burns rapidly and expands, forcing the piston down.

4 Blow



Exhaust stroke

The exhaust valve is open and the piston is moving up, to push out the waste gases. The cycle then begins again.

Class 12

Brain Map: Geometrical Optics

NEET | JEE Essentials: Semiconductors Devices & Communication Device

Exam Prep -2020

Ace Your Way CBSE : Practices Papers 2020

MPP-9: Atoms and Nuclei

Covering all GCSE specifications, this tried and tested series has been fully updated to match the (9-1) GCSE Physics specifications for first examination in 2020, as well as international specifications. With a focus on science, concepts develop naturally, engaging students and enabling them to get a thorough understanding of Physics.

Competition Edge

Physics Musing Problem Set 54

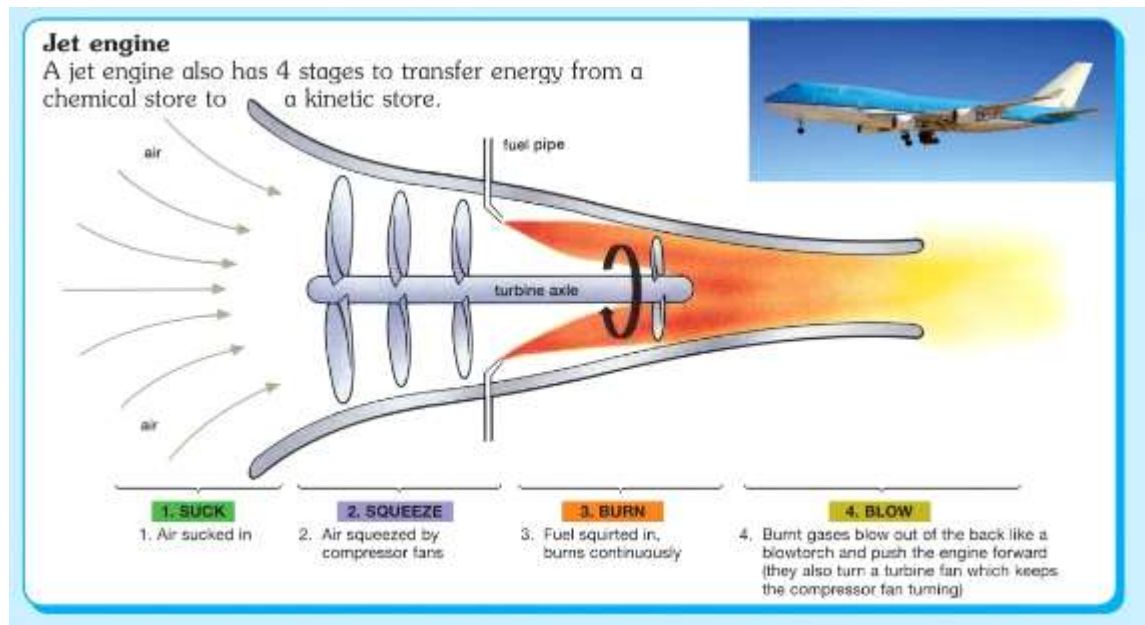
JEE Main Practice Paper 2020

JEE Work Outs

At a Glance 2017

Physics Musing Solution Set 53

FEBRUARY 2020



Competition Edge

Physics Musing Problem Set 55

JEE Main Practice Paper

NEET Practice Paper

Gear Up for AIIMS

Physics Musing Solution Set 54

Class 11

Brain Map: Gravitational Field & Potential
NEET | JEE Essentials: Oscillation and Wave

Ace Your Way CBSE

MPP-10: Wave

Class 12

Brain Map: Interference of Light

Exam Prep :2020

Ace Your Way CBSE: Practices Paper 2020

MPP -Monthly Practice Paper

MARCH 2020

Competition Edge

Physics Musing Problem Set 56

JEE Main Practice Paper

NEET Practice Paper

Physics Musing Solution Set 55

JEE Advanced Practice Paper

Gear Up for AIIMS

BITSAT Full Length Practice Paper

Class 11

Brain Map: Fluid in Motion

MPP: Monthly Practices Problems

Class 12

Brain Map: Quantum Theory of Light

CBSE Board Practice Paper

MPP: Monthly Practices Problems

APRIL 2020

Physics Musing Problem Set 57

NEET Practice Paper

JEE Advanced Practice Paper

10 Most Frequently Asked Topics in NEET

JEE Main Practice Paper

Physics Musing Solution Set 56

Brain Map XI - Surface Tension

Brain Map XII - Bohr Atomic Model

Gear Up for AIIMS

BITSAT Practice Paper

You Ask We Answer

CBSE Board Solved Paper 2020

Crossword

MAY 2020

Physics Musing Problem Set 58

NEET Practice Paper

7 Most Frequently Asked Chapters in JEE Advanced

JEE Advanced Practice Paper 2020
Brain Map- Heat Transfer, Class XI
Brain Map -Radioactivity, Class XII
Gear Up for AIIMS 2020
JEE Main Solved Paper 2020
Physics Musing Solution Set 57
BITSAT Practice Paper 2020
MPP (Monthly Practice Paper) Class XI
MPP (Monthly Practice Paper) Class XII
Crossword - Electrostatics Class XII

JUNE 2020

Physics Musing Problem Set 59
Be NEET Ready
Be JEE Ready
NEET Solved Paper 2020
JEE Main Solved Paper 2020
WB JEE Solved Paper 2020
Brain Map
Karnataka Solved Paper 2020
J & K CET Solved Paper 2020
You ask we answer
10 Mind Blowing Olympiad Problems
CBSE Drill (Class XII)
Live Physics

Physics Musing Solution Set 58

Crossword

JULY 2020

Class 11

Focus NEET / JEE - Units and Measurement

Be JEE Ready

Monthly Tune Up – Units and Measurement

CBSE Drill - Physical World, Measurements and Kinematics

Brain Map - Kinematics

Class 12

Focus NEET / JEE 2020 - Electrostatics

CBSE Drill - Current Electricity

Be NEET Ready

Monthly Tune Up- Electrostatics

Competition Edge

Physics Musing Problem Set 60

Success Story - Tejaswini Banbare (NEET 2020, AIR 54)

JEE Advanced Solved Paper 2020

Physics Musing Solution Set 59

Crossword - Current Electricity

Live Physics - Stephen Hawking last paper co-authored with European Research Council grantee
Thomas

Hertog proposes a new cosmological theory

AUGUST 2020

Class 11

Focus NEET / JEE 2020 KINEMATICS

Be NEET Ready with Exclusive and brain storming MCQs

Monthly Tune Up Kinematics

CBSE Drill Laws of Motion | Work, Energy and Power

Brain Map ELECTROSTATICS

Class 12

Focus NEET / JEE 2020 CURRENT ELECTRICITY

Be JEE Ready with exclusive and brain storming MCQs

CBSE Drill Magnetic Effects of Current and Magnetism

Monthly Tune Up Current Electricity

Competition Edge

Physics Musing Problem Set 61

AMU (Engg.) Solved Paper 2020

Physics Musing Solution Set 60

Live Physics

Crossword

SEPTEMBER 2020

Class 11

Focus NEET / JEE - LAWS OF MOTION, WORK, ENERGY AND POWER

Be JEE Ready with exclusive and brain storming MCQs

CBSE Drill - System of Particles and Rotational Motion, Gravitation

Monthly Tune Up - Laws of Motion, Work, Energy and Power

Brain Map - LAWS OF MOTION

Class 12

Focus NEET / JEE - MAGNETIC EFFECTS OF CURRENT AND MAGNETISM

Be NEET Ready - with Exclusive and brain storming MCQs

CBSE Drill - Electromagnetic Induction, Alternating Current

Monthly Tune Up - Magnetic Effect of Current and Magnetism

Competition Edge

Physics Musing Problem Set 62

JEE Work Outs

Tips Corner - 15 Scientific Way To Learn Faster

Olympiad Problems

Physics Musing Solution Set 61

Live Physics

Crossword

OCTOBER 2020

Class 11

Focus NEET / JEE 2020 - SYSTEM OF PARTICLES AND ROTATIONAL MOTION

Be NEET Ready with Exclusive and brain storming MCQs

CBSE Drill- Mechanical Properties of Solids | Mechanical Properties of Fluids

Monthly Tune Up - System of Particles and Rotational Motion

Class 12

Focus NEET / JEE 2020 - ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

Brain Map - CURRENT ELECTRICITY

Be JEE Ready with exclusive and brain storming MCQs

CBSE Drill - Electromagnetic Waves | Optics

Monthly Tune Up - Electromagnetic Induction and Alternating Current

Competition Edge

Tips Corner - 15 ways to master the art of self-discipline

Physics Musing Problem Set 63

Gear Up for JEE Main 2020

Live Physics

Physics Musing Solution Set 62

Crossword

NOVEMBER 2020

Class 11

Focus NEET / JEE: Gravitation

Be JEE Ready

CBSE Drill: Thermal Properties of Matter | Thermodynamics | Kinetic Theory

Monthly Tune Up: Gravitation

Class 12

Focus NEET / JEE: Electromagnetic Waves and Optics

Brain Map: Work, Energy and Power

Be NEET Ready

CBSE Drill: Dual Nature of Radiation and Matter | Atoms | Nuclei

Monthly Tune Up: Electromagnetic Waves and Optics

Competition Edge

Physics Musing Problem Set 64

Gear Up for JEE Main 2020

Tips Corner

Physics Musing Solution Set 63

Live Physics

Crossword

DECEMBER 2020

Class 11

Focus NEET / JEE: Mechanical Properties of Solids and Fluids

CBSE Drill: Oscillations and Waves

Monthly Tune Up: Mechanical Properties of Solids and Fluids

Brain Map: System of Particles and Rotational Motion

Class 12

Focus NEET / JEE: Modern Physics

CBSE Drill: Electronic Devices | Communication Systems

Monthly Tune Up: Modern Physics

Competition Edge

Physics Musing Problem Set 65

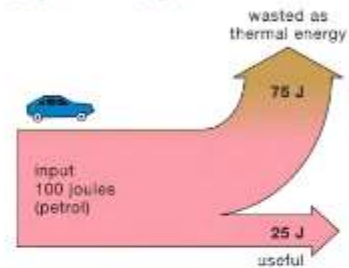
Gear Up for JEE Main 2020 Full Length

Physics Musing Solution Set 64



Machines transfer energy from one store to another. We know that the total amount of energy put into a machine must equal the total amount of energy output. This is the principle of conservation of energy (see page 102). However, only **some** of the output energy is useful to us. The rest is wasted energy. This affects the **efficiency** of the machine.

A car is not very efficient. For every 100 joules of energy (in fuel) that is put into the car, only 25 J appear as useful energy to move the car. The other 75 J is wasted as thermal energy. It is low-grade energy and we cannot use it. The efficiency is calculated by:



$$\text{Efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

or

$$\text{Efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

Example 1
For this car, the efficiency = $\frac{25}{100} = 0.25$ or 25%.

Because of friction in a machine there is always some wasted energy. This means the efficiency is **always less than 100%**.



*Efficiency will soon decrease
If you forget the oil and grease*