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ENERGY FORMS & CONVERSION

1.1 Energy sources and forms

1.2 Energy conversion

1.3 Energy storage and conservation

Learning Outcomes

Candidates should be able to:

Knowledge, Understanding and Application

(a) state what is meant by energy

(b) describe different forms of energy (e.g. kinetic, potential, light and sound) and how energy changes from one form to another

Skills and Processes

(a) infer that energy is conserved and can be transformed from one form to another

Ethics and Attitudes

(a) show an appreciation of the need for Singapore, which has no natural resources of her own, to conserve energy

1.1 Energy sources and forms

MCQs

09ZA01-01-01

Which statements are correct?

(I) Solar energy is a non-renewable source of energy because it is unavailable at night.

(II) Fossil fuels are renewable sources of energy because we can always extract these fuel sources underground.

(III) Nuclear reactions in nuclear plant release large amount of nuclear energy which can be used to convert into electrical energy.

(IV) Wind is a natural source of energy. It is also renewable and clean.

(A) (I), (II)

(B) (III), (IV)

(C) (I), (III), (IV)

(D) (I), (II), (III), (IV)

09ZA01-01-02

Which statements are false?

(A) Solar cells are found in calculators.

(B) Solar panels are painted back to be used for heating up water at home.

(C) Solar collectors are expensive equipments used for power consumption in spacecrafts.

(D) None of the above.

09ZA01-01-03

What are the limitations of wind energy as a source of energy to convert into electrical energy for general use?

(I) Wind energy is not efficient in converting into electrical energy.

(II) Not all countries have ample land to build wind farms to generate electrical energy.

(III) Even though wind is renewable, it might not be present all the time.

(IV) For small countries like Singapore, wind energy is not economically practical to adopt.

(A) (I), (II), (III)

(B) (II), (III), (IV)

(C) (III), (IV)

(D) (I), (II), (III), (IV)

09ZA01-01-04

How can wave energy be harnessed and converted to electrical energy?

(A) Wave surge devices

(B) Floats or pitching devices

(C) Oscillating wave columns

(D) All of the above.

09ZA01-01-05

What are the disadvantages of using hydroelectric energy?

(I) Hydroelectric energy is not renewable.

(II) Hydroelectric energy produces only a small amount of electricity.

(III) Large areas of land are required to build large dams.

(IV) Building hydroelectric power plants destroys wildlife.

(A) (I), (II)

(B) (III), (IV)

(C) (I), (IV)

(D) (I), (II), (III), (IV)

09ZA01-01-06

What are the advantages of using wave energy as a form of energy to convert into electrical energy?

(I) The waves do not have to be strong since wave energy can be harnessed easily and efficiently.

(II) Using wave energy as a source of energy produces only a little pollution.

(III) Large amount of electrical energy can be converted.

(IV) Wave energy is renewable.

(A) (I), (II)

(B) (III), (IV)

(C) (II), (III), (IV)

(D) (I), (II), (III), (IV)

09ZA01-01-07

What is one of the advantages of using tidal energy as a source of energy?

(A) It is cost-effective.

(B) It has little impact on marine life.

(C) The tidal barrage is easy and cheap to build.

(D) It is available at all times.

09ZA01-01-08

Name the sources of geothermal energy?

(A) Volcanoes

(B) Hot springs

(C) Geysers

(D) All of the above

09ZA01-01-09

What are the advantages of using geothermal energy to convert into electrical energy for general use?

(A) It is not expensive.

(B) It is pollution-free.

(C) It is easy to harness geothermal energy.

(D) None of the above.

09ZA01-01-10

Which statements are correct?

(I) Fossil fuels are renewable sources of energy.

(II) Coal, crude oil and natural gas are fossil fuels

(III) Fossil fuels are formed from dead plants and animals.

(IV) Fossil fuels contain sulphur as one of the impurities.

(A) (I), (II)

(B) (II), (III)

(C) (III), (IV)

(D) (II), (III), (IV)

09ZA01-01-11

Many compounds can be obtained through fractional distillation of petroleum. These compounds include diesel, kerosene, bitumen and petrol. Which uses are false?

(I) Petrol is used as a fuel for motor vehicles.

(II) Kerosene is used in lorries and trucks.

(III) Bitumen is used to make other chemicals.

(IV) Diesel can be used as jet fuel.

(A) (II), (III)

(B) (III), (IV)

(C) (I), (II), (IV)

(D) (II), (III), (IV)

09ZA01-01-12

Which one of the following statements is false?

(A) Wood, waste and ethanol are some examples of biomass.

(B) Biomass is non-renewable.

(C) Using biomass as a fuel causes air pollution.

(D) None of the above.

09ZA01-01-13

Which group does not contain all examples of biomass?

(A) Methane, ethane, propane

(B) Wood chips, sawdust, shrubs

(C) Animal dung, ethanol, rubbish

(D) None of the above

09ZA01-01-14

Which one of the following statements is true?

(A) Nuclear energy is mainly generated by nuclear fusion.

(B) Uranium and plutonium are used as nuclear fuels.

(C) Nuclear power depends on the Sun.

(D) Nuclear power causes global warming.

09ZA01-01-15

What are the disadvantages of using nuclear power as a source of energy?

(I) Nuclear plants can produce radioactive wastes.

(II) If there is a leakage, contamination can occur. This leads to long term health defects.

(III) Nuclear fuels are non-renewable.

(IV) Nuclear power causes air pollution.

(A) (II), (III)

(B) (I), (IV)

(C) (I), (II), (III)

(D) (I), (II), (III), (IV)

Questions – 1.1

09ZA01-01-16

Explain how burning of fossil fuels causes acid rain.

09ZA01-01-17

Global warming, a phenomenon of worldwide increased temperature, is caused by burning of fossil fuels. Based on your knowledge, explain why.

09ZA01-01-18

Since renewable sources of energy are more environmentally-friendly, explain why fossil fuels are still the primary source of energy.

09ZA01-01-19

State the uses of petroleum and the products that can be obtained from it.

09ZA01-01-20

Explain why nuclear fuels and wastes need to be carefully stored and disposed of.

1.2 Energy conversion

MCQs

07ZZ01-02-01

Which of the following represents the main energy changes that take place in battery-operated torchlight?

(A) Chemical → Electrical → Light + Heat

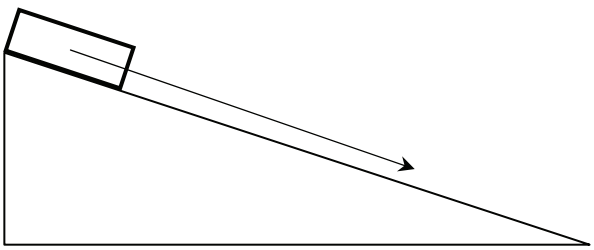
(B) Electrical → Chemical → Light + Heat

(C) Electrical → Kinetic → Light + Heat

(D) Kinetic → Electrical → Light + Heat

07ZZ01-02-02

An object is travelling down the slope as shown in the diagram below.

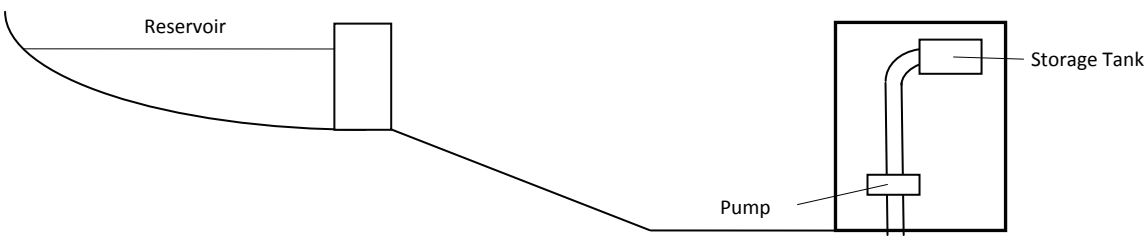


How does the object's energy change?

	Potential Energy	Kinetic Energy
(A)	Decreases	Decreases
(B)	Decreases	Increases
(C)	Increases	Decreases
(D)	Increases	Increases

07ZZ01-02-03

An apartment block receives water from a nearby reservoir. A pump is necessary to lift the water to a storage tank at the top of the building.



What is the energy change from the reservoir to the top of the building?

(A) Chemical → Kinetic → Potential

(B) Kinetic → Potential → Kinetic

(C) Kinetic → Potential → Sound

(D) Potential → Kinetic → Potential

09ZA01-02-04

In harnessing hydroelectric energy, what is the sequence of conversion of energy?

(A) Gravitational potential energy → Kinetic energy → Electrical energy

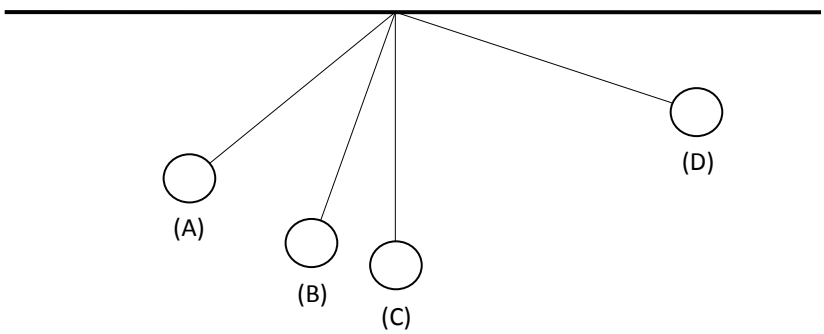
(B) Kinetic energy → Electrical energy

(C) Gravitational potential energy → Electrical energy

(D) Kinetic energy → Heat energy.

09ZA01-02-05

Which position does the pendulum has the highest kinetic energy?



09ZA01-02-06

Which source(s) of energy does/do not involve the release of heat energy when converted to electrical energy?

(I) Wind energy

(II) Nuclear energy

(III) Hydroelectric energy

(IV) Geothermal energy

(A) (I), (III)

(B) (I), (II), (III)

(C) (II), (IV)

(D) None of the above.

09ZA01-02-07

State the conversion of energy when a mobile phone is switched on.

(A) Electrical energy → Heat energy + Light energy + Sound energy

(B) Chemical energy → Kinetic energy → Heat energy + Light energy + Sound energy

(C) Electrical energy → Chemical energy → Heat energy + Light energy + Sound energy

(D) Chemical energy → Electrical energy → Heat energy + Light energy + Sound energy

09ZA01-02-08

Which one of the following statements is true?

(A) Energy can be created and destroyed.

(B) Energy cannot be transmitted.

(C) The total amount of energy is always the same.

(D) None of the above.

09ZA01-02-09

In machines, energy conversion is always not 100%. This means that not all the electrical energy supplied to the machines is converted to kinetic energy used to allow machines to function properly. Explain why.

(A) Some energy is destroyed during the conversion.

(B) Some energy is converted to other forms of energy which the machines cannot use to function.

(C) Some energy remains unconverted.

(D) None of the above.

Questions – 1.2

07ZZ01-02-10

John has only one meal a day which he takes in the morning before he starts work. What can he eat so that he will have enough energy to last the whole day? Choose your food from the list given below.

Burger – 89.5 kJ

Doughnut – 146.5 kJ

Milk – 70 kJ

Ice cream – 45 kJ

07ZZ01-02-11

State the energy change when carrying heavy objects up the stairs.

1.3 Energy storage and conservation

MCQs

09ZA01-03-01

Which statements are false?

(I) Batteries store chemical energy.

(II) Liquid petroleum gas is stored in cylinders.

(III) Solar energy can be stored in batteries.

(IV) Wind power can be stored in batteries

(A) (I), (II)

(B) (III), (IV)

(C) (II), (III), (IV)

(D) None of the above.

09ZA01-03-02

What are the reasons for conservation of energy?

(A) Fossil fuels are non-renewable.

(B) Conservation of energy reduces air pollution

(C) The demand for energy is increasing due to industrialisation

(D) All of the above

09ZA01-03-03

Which one of the following does not conserve energy?

(A) Use energy efficient machines

(B) Turning off electrical appliances when not in use

(C) Build more power plants to supply more electricity

(D) Recycling

09ZA01-03-04

Research has been done in using hydrogen fuel cells to power cars. The hydrogen fuel cells use hydrogen and oxygen gases to release energy, forming water as a by-product. Explain why hydrogen fuel cells are good alternative sources of energy.

(A) Hydrogen fuel cells use gaseous materials as fuels.

(B) Both hydrogen and oxygen gases are readily available.

(C) Hydrogen fuel cells are safe to use as an energy source.

(D) Water is a by-product.

09ZA01-03-05

How does conservation of energy lead to less pollution?

(A) Lower amount of fossil fuels are burnt to release carbon dioxide, sulphur dioxide and oxides of nitrogen.

(B) Fewer cars on the road ensure lower amount of carbon monoxide and oxides of nitrogen released.

(C) Recycling of recyclable materials ensures that less processing of metal ores and manufacturing of new products.

(D) All of the above.

Questions – 1.3

09ZA01-03-06

Explain the need for storage and conservation of energy.

09ZA01-03-07

State the ways of saving energy in order to reduce global warming.

Answer keys:

1.1

09ZA01-01-01	B
09ZA01-01-02	D
09ZA01-01-03	B
09ZA01-01-04	D
09ZA01-01-05	B
09ZA01-01-06	B
09ZA01-01-07	D
09ZA01-01-08	D
09ZA01-01-09	D
09ZA01-01-10	D
09ZA01-01-11	D
09ZA01-01-12	B
09ZA01-01-13	D
09ZA01-01-14	B
09ZA01-01-15	C

1.2

07ZZ01-02-01	A
07ZZ01-02-02	B
07ZZ01-02-03	D
09ZA01-02-04	A
09ZA01-02-05	C
09ZA01-02-06	A
09ZA01-02-07	D
09ZA01-02-08	C
09ZA01-02-09	B

07ZZ01-02-10
Doughnut

07ZZ01-02-11
Chemical potential energy $\rightarrow$ Kinetic energy + Heat energy

1.3

09ZA01-03-01	D
09ZA01-03-02	D
09ZA01-03-03	C
09ZA01-03-04	D
09ZA01-03-05	D

Notes: