Energy, work and power – 2020 O Level 5054

1. Nov/2020/Paper_11/No.14

There is a current in a resistor.

Which energy transfer takes place?

A electrical → chemical

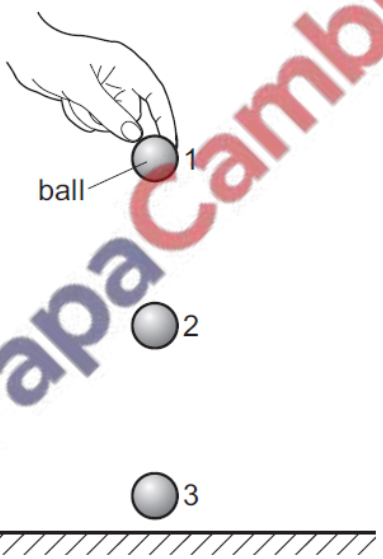
B electrical → internal

C kinetic → electrical

D potential → electrical

2. Nov/2020/Paper_11/No.15

A ball is dropped from a height as shown.



Ignoring the effects of air resistance, which statement about the total energy of the ball is correct?

A It is the same at all points.

B It is greatest at point 1.

C It is greatest at point 2.

D It is greatest at point 3.

3. Nov/2020/Paper_11/No.16

Which source of electrical energy is **not** renewable?

A solar cells

B hydroelectric generators

C wind turbines

D nuclear reactors

4. Nov/2020/Paper_11/No.17

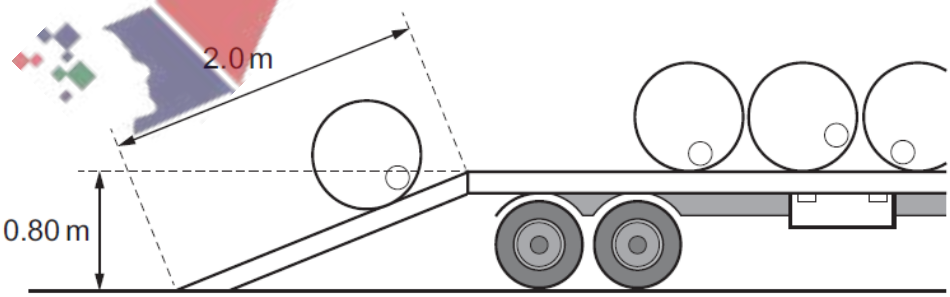
The table shows some data from a high-jump competition.

Which athlete jumps the highest?

	weight / N	increase in gravitational potential energy / J
A	600	1320
B	700	1610
C	800	1760
D	900	1800

5. Nov/2020/Paper_11/No.18

A workman rolls a barrel of weight 2000 N up a plank of length 2.0 m and onto a lorry. The back of the lorry is 0.80 m above the horizontal surface of the road.



What is the work done on the barrel against gravity?

A 1000 J **B** 1600 J **C** 2500 J **D** 4000 J

6. Nov/2020/Paper_11/No.19

Data for three types of electricity generator are shown.

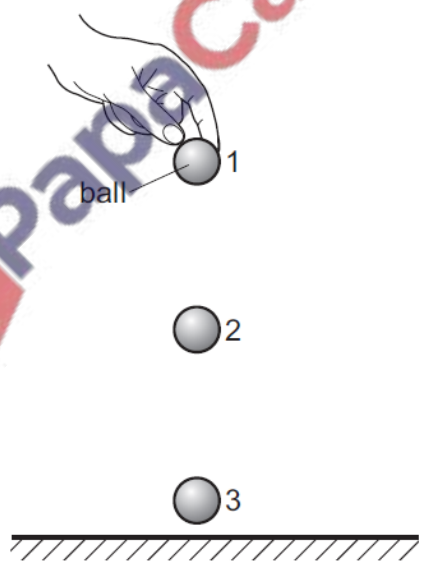
	input energy / MJ	wasted energy / MJ
oil	500	300
nuclear	200	160
hydroelectric	10	1.0

Which is the least efficient generator and which is the most efficient?

	least efficient	most efficient
A	hydroelectric	nuclear
B	hydroelectric	oil
C	nuclear	hydroelectric
D	oil	hydroelectric

7. Nov/2020/Paper_12/No.13

A ball is dropped from a height as shown.



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C It is greatest at point 2.

D It is greatest at point 3.

8. Nov/2020/Paper_12/No.14

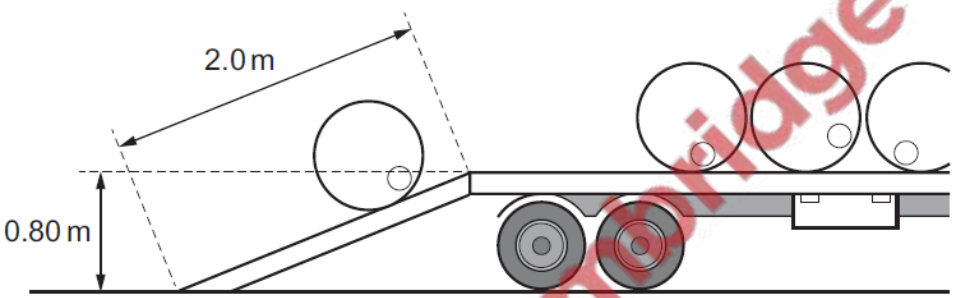
A student uses an average force of F to push a box a distance of d across a horizontal table. The mass of the box is m and the gravitational field strength is g.

How is the work done by the student pushing the box calculated?

A $F \times d$ **B** $\frac{F \times d}{g}$ **C** $m \times d$ **D** $m \times g \times d$

9. Nov/2020/Paper_12/No.15

A workman rolls a barrel of weight 2000 N up a plank of length 2.0 m and onto a lorry. The back of the lorry is 0.80 m above the horizontal surface of the road.



What is the work done on the barrel against gravity?

A 1000 J **B** 1600 J **C** 2500 J **D** 4000 J

10. Nov/2020/Paper_12/No.16

What is *power*?

A force per second

B the maximum force an object exerts

C the total energy of an object

D work done per second

11. Nov/2020/Paper_22/No.2

The total mass of a wheelbarrow and its load is 90 kg. A worker pushes the wheelbarrow and load up a plank of length 2.0 m on to a platform, as shown in Fig. 2.1. The platform is at a height of 0.60 m above the ground.

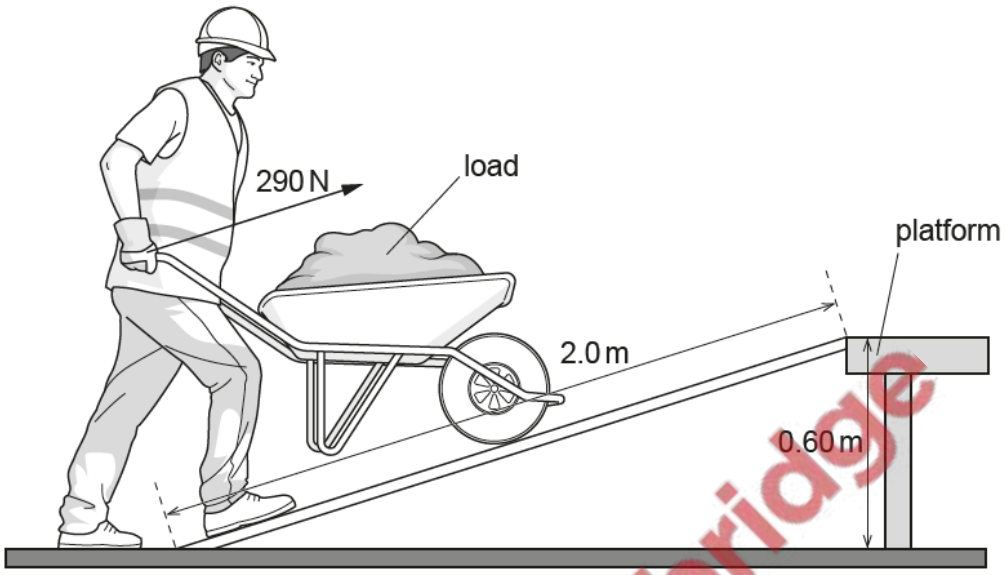


Fig. 2.1

The worker exerts a force of 290 N on the wheelbarrow in the direction in which the wheelbarrow moves.

(a) The gravitational field strength g is equal to 10 N/kg.

(i) Calculate the gravitational potential energy gained by the wheelbarrow and its load.

energy = ... [2]

(ii) The worker pushes the wheelbarrow 2.0 m along the plank.

Calculate the work done on the wheelbarrow by the worker.

work done = ... [2]

(iii) Suggest one reason why the answer to **(a)(ii)** is not equal to the answer to **(a)(i)**.

.....

..... [1]

(b) The worker finds that walking up the plank pushing the wheelbarrow is even more inefficient than the answers in **(a)** suggest.

(i) State what is meant by *efficiency*.

.....

..... [1]

(ii) Suggest **one** reason why this method of lifting the load onto the platform is so inefficient.

.....

..... [1]

[Total: 7]

12. June/2020/Paper_11/No.12

A rocket of mass M when empty carries a mass M of fuel. The rocket and fuel travel at speed v. The engine of the rocket is fired and all of the fuel is expelled. The speed of the rocket increases to $2v$.

What happens to the kinetic energy of the rocket?

A It doubles.

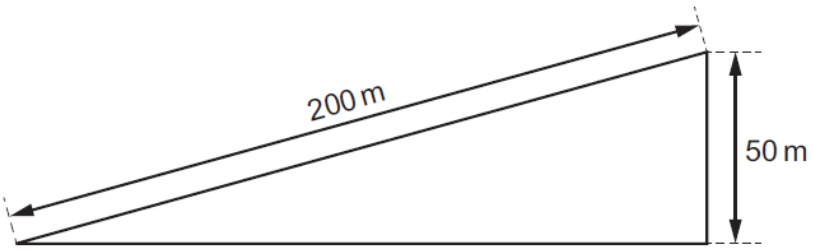
B It halves.

C It increases by a factor of four.

D It stays the same.

13. June/2020/Paper_11/No.13

A car of mass 1000 kg is driven 200 m up an incline so that it rises 50 m vertically.



The acceleration of free fall g is 10 m / s^2.

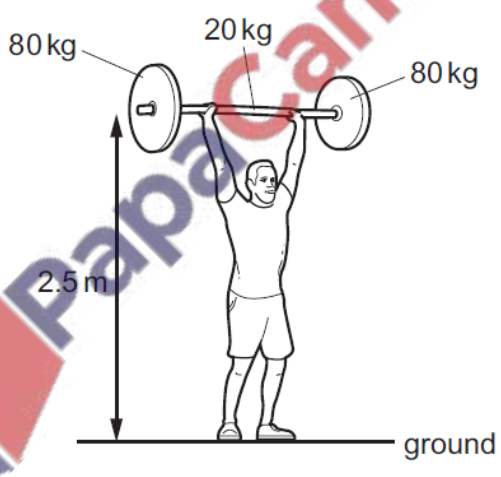
What is the gain in gravitational potential energy?

A 5000 J **B** 200 000 J **C** 500 000 J **D** 2 000 000 J

14. June/2020/Paper_11/No.16

In a weightlifting contest, an athlete lifts a metal bar of mass 20 kg fitted with a mass of 80 kg on each end.

The lift from ground to a height of 2.5 m takes 0.50 s.



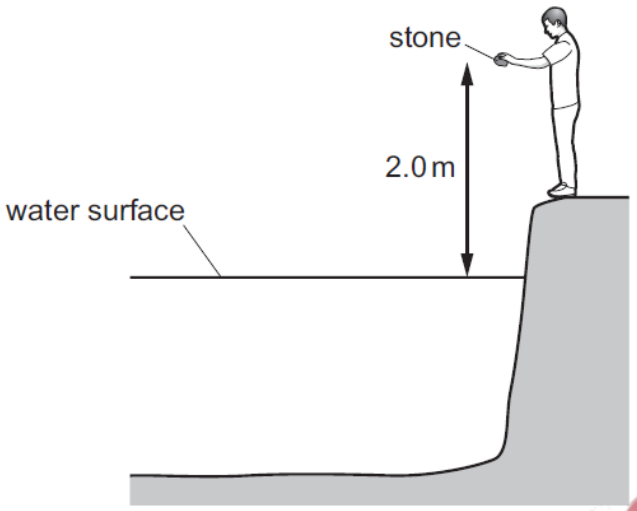
The gravitational field strength g is 10 N / kg.

What average power does the weightlifter exert in providing the gravitational potential energy during this lift?

A 0.90 kW **B** 5.0 kW **C** 8.0 kW **D** 9.0 kW

15. June/2020/Paper_11/No.17

A boy is standing by the side of a lake.



The boy drops a heavy stone from a height of 2.0 m above the water surface.

The acceleration due to gravity is $10\,m/s^2$.

What is the speed of the stone when it hits the surface of the water?

A 4.5 m/s **B** 6.3 m/s **C** 20 m/s **D** 40 m/s

16. June/2020/Paper_11/No.18

In which situation is energy being released by the fusion of hydrogen nuclei to form helium?

A in the decay of ^{14}C used to date an object

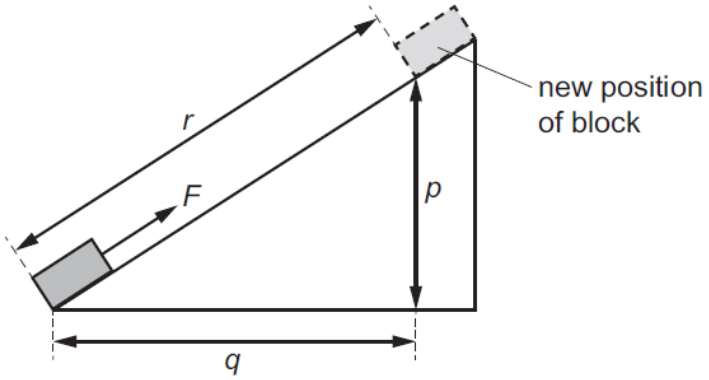
B in a radioactive isotope emitting alpha-particles

C in the centre of the Earth

D in the centre of the Sun

17. June/2020/Paper_11/No.19

The diagram shows a block being pulled up a slope by a force *F*.



The block reaches the new position at the top of the slope.

What is the work done by force *F* in moving the block to its new position?

A $F \times r$ **B** $F \times p$ **C** $F(q + p)$ **D** $F(r + p)$

18. June/2020/Paper_12/No.16

A rocket of mass *M* when empty carries a mass *M* of fuel. The rocket and fuel travel at speed *v*. The engine of the rocket is fired and all of the fuel is expelled. The speed of the rocket increases to 2*v*.

What happens to the kinetic energy of the rocket?

A It doubles.

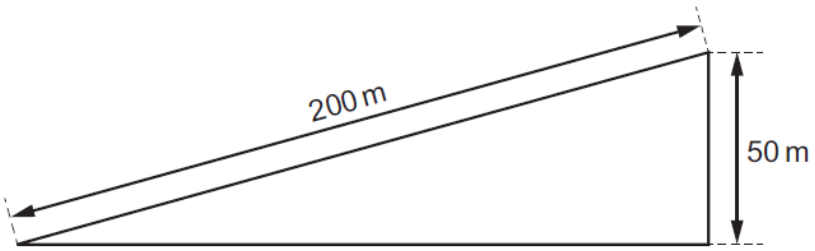
B It halves.

C It increases by a factor of four.

D It stays the same.

19. June/2020/Paper_12/No.17

A car of mass 1000 kg is driven 200 m up an incline so that it rises 50 m vertically.



The acceleration of free fall g is $10\,m/s^2$.

What is the gain in gravitational potential energy?

A 5000 J **B** 200 000 J **C** 500 000 J **D** 2 000 000 J

20. June/2020/Paper_12/No.18

In which situation is energy being released by the fusion of hydrogen nuclei to form helium?

A in the decay of ^{14}C used to date an object

B in a radioactive isotope emitting alpha-particles

C in the centre of the Earth

D in the centre of the Sun

21. June/2020/Paper_12/No.19

The main stages in the operation of a coal-fired power station are listed. They are **not** in the correct order.

1 The turbine turns a generator.

2 Water in the boiler becomes hot.

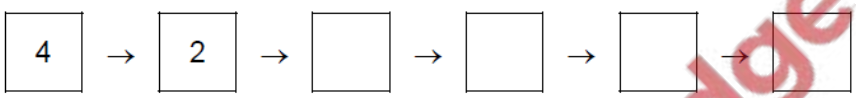
3 Steam turns a turbine.

4 Burning coal produces thermal energy.

5 Electromagnetic induction produces electrical energy.

6 Steam is produced.

The flow chart shows the first two stages.



What is the correct order for the remaining stages?

A 6 → 3 → 1 → 5

B 6 → 1 → 3 → 5

C 1 → 6 → 3 → 5

D 6 → 3 → 5 → 1

22. June/2020/Paper_12/No.21

The 200 V battery of an electric car is charged with a current of 33 A for 4.0 hours. The efficiency of the charging process is 90%.

How much useable energy is transferred to the battery?

A 21 MJ **B** 86 MJ **C** 95 MJ **D** 106 MJ

23. June/2020/Paper_12/No.22

In an experiment to measure the power output of a small steam engine, a known load is lifted by the engine.

Which two measuring instruments are also required?

A measuring cylinder and thermometer

B measuring cylinder and metre rule

C metre rule and stop-watch

D stop-watch and thermometer

24. June/2020/Paper_21/No.10a

Fig. 10.1 shows a motor lifting a mass. Fig. 10.2 shows part of the circuit diagram of the connections to the motor.

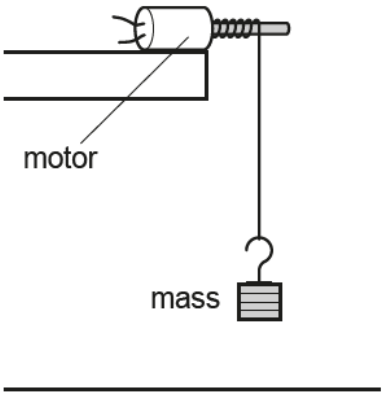


Fig. 10.1

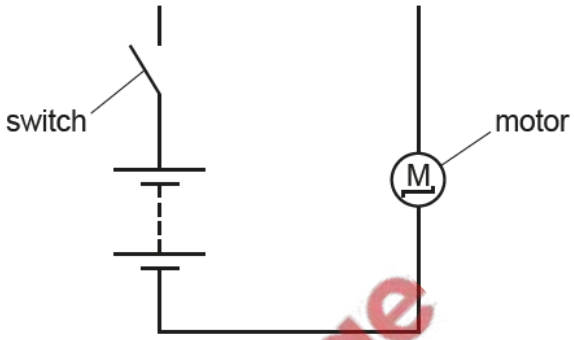


Fig. 10.2

(a) The current in the motor is 1.5A and the voltage supplied by the battery is 8.0V.

(i) Complete the circuit diagram in Fig. 10.2 to show an ammeter and a voltmeter in the correct positions to take these measurements while the motor is working. [2]

(ii) The motor takes 4.0s to lift the mass.

Calculate the electrical energy transferred to the motor in this time.

energy = ... [2]

(iii) The motor lifts the 150g mass through a height of 80cm in the 4.0s.

Calculate the gravitational potential energy gained by the mass.

The gravitational field strength g = 10N/kg.

gravitational potential energy = ... [3]

(iv) State **two** reasons why the gravitational potential energy gained by the mass is less than the electrical energy supplied to the motor.

1. .....

2. .....

[2]

25. June/2020/Paper_22/No.3c

Fig. 3.1 shows part of a hydraulic press that is used to compress waste paper into a brick for burning.

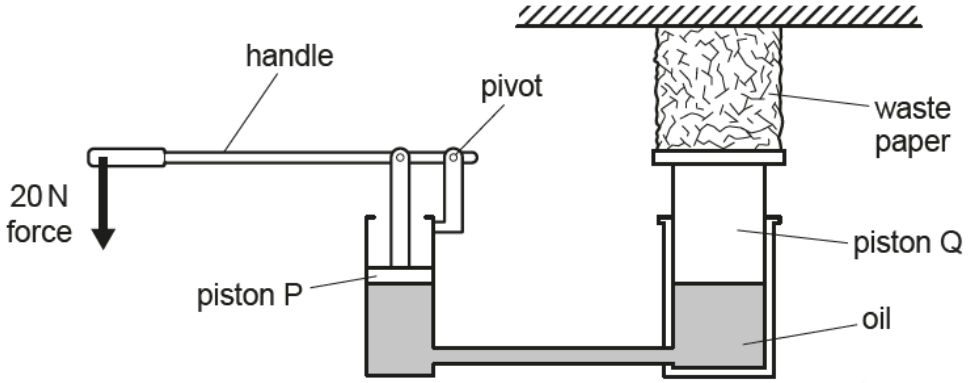


Fig. 3.1

A force of 20 N is exerted downwards on the end of the handle.

(c) In moving the handle downwards, the 20 N force moves through a distance of 0.60 m and piston Q rises by 0.020 m.

The force exerted by piston Q on the paper is 400 N.

Calculate:

(i) the work done in moving the handle downwards

work = ... [2]

(ii) the efficiency of the hydraulic press.

efficiency = ... [2]