Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/12**

Paper 1 Multiple Choice **October/November 2020**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

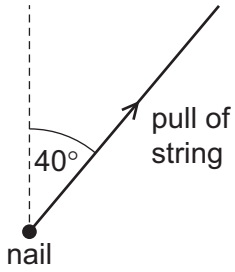
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.

This document has **16** pages. Blank pages are indicated.

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1 A heavy nail is fixed firmly to a wall. It is pulled by a string at 40° to the vertical. The nail does not move.



Three forces act on the nail:

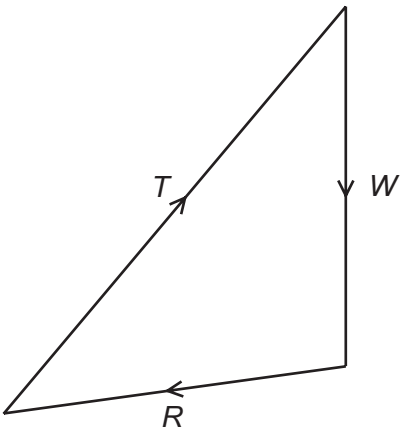
its weight *W*,

the tension *T* in the string,

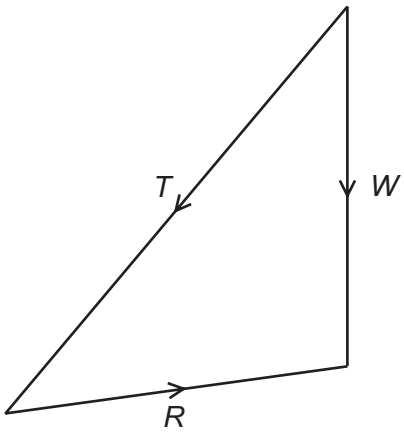
the force *R* exerted by the wall.

Which diagram, drawn to scale, represents the three forces?

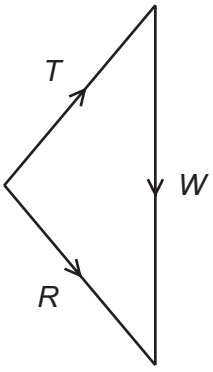
A



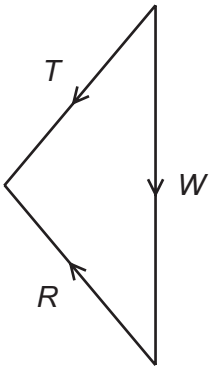
B



C



D



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2 A car begins to move. It speeds up until it reaches a constant speed. It continues to travel at this constant speed for the rest of the journey.

What happens to the acceleration and what happens to the velocity of the car during the journey?

A Both the acceleration and the velocity change.

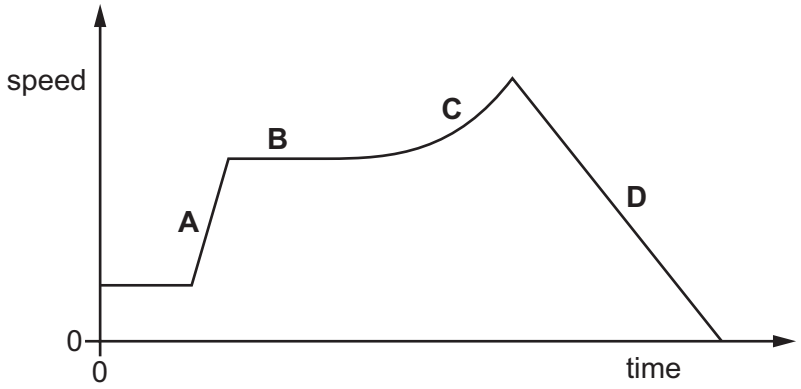
B Only the acceleration changes.

C Only the velocity changes.

D Neither the acceleration nor the velocity changes.

3 The speed–time graph for a car's journey is shown.

During which part of the journey is the car moving with non-uniform acceleration?



4 A car is travelling forwards at high speed. The brakes are applied and the car skids along the road surface.

In which direction and where does the friction force act?

A backwards on the tyres

B forwards on the tyres

C upwards on the tyres

D downwards on the road

5 A car of mass 800 kg has a forward acceleration of 2.5 m / s^2. A frictional force of 1200 N opposes the motion of the car.

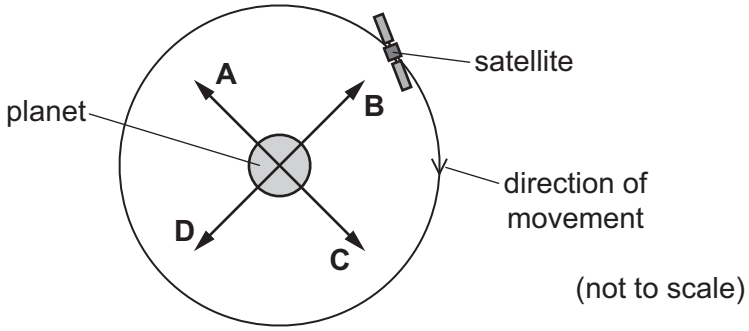
What is the driving force due to the engine of the car?

A 800 N **B** 1200 N **C** 2000 N **D** 3200 N

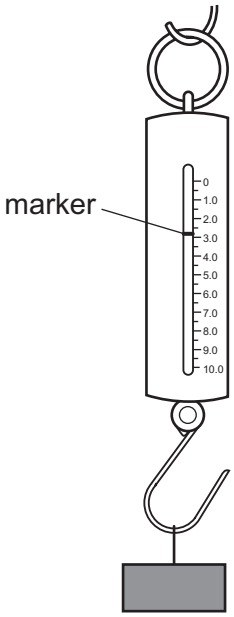
6 A satellite orbits a planet in a circular path as shown. It has constant speed.

There is a force on the planet due to the satellite.

In which direction is the force on the planet?



7 A block is hung on a spring balance. The marker inside the balance is pulled down by the block.



What can the position of the marker be used to determine?

A the mass of the block in kg

B the mass of the block in N

C the moment caused by the block in N

D the weight of the block in kg

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8 There is an astronaut on a planet which has a gravitational field strength one fifth of the value on Earth.

He hangs samples of rock from a spring balance designed for use on Earth. Each sample has a mass of 0.1 kg.

The spring balance reads 1.0 kg.

How many samples of rock are there?

A 2 **B** 10 **C** 25 **D** 50

9 An electrically charged plastic ball is at rest.

Which types of field are caused by the ball?

A electric, gravitational and magnetic

B electric and gravitational only

C electric and magnetic only

D gravitational and magnetic only

10 Which list contains only quantities that can be changed by a force?

A mass, shape, velocity

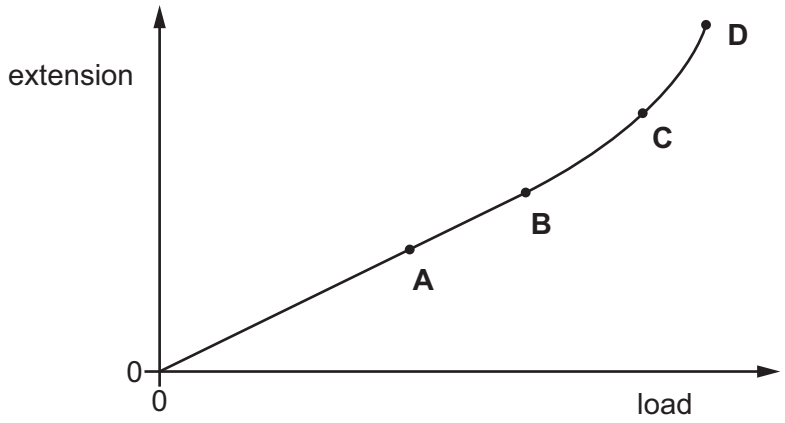
B mass, shape, volume

C mass, velocity, volume

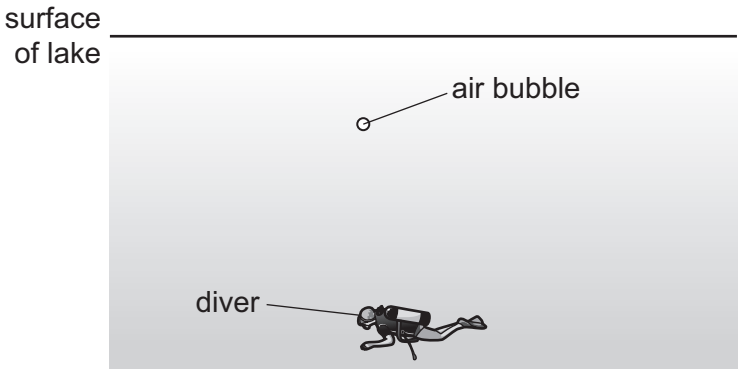
D shape, velocity, volume

11 An extension–load graph is plotted for a spring.

Which point marks the limit of proportionality for this spring?



12 The diagram shows a diver 20 m below the surface of a lake. The total pressure at this depth is 3.0×10^5 Pa.



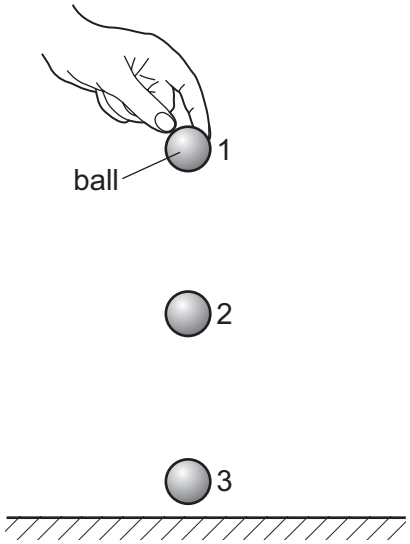
(not to scale)

An air bubble has a volume of 0.60 cm^3 as it leaves the diver. It rises to the surface of the lake where the pressure is 1.0×10^5 Pa. The temperature of the air in the bubble remains constant.

What is the volume of the air bubble at the surface of the lake?

A 0.20 cm^3 **B** 0.60 cm^3 **C** 1.8 cm^3 **D** 2.4 cm^3

13 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.

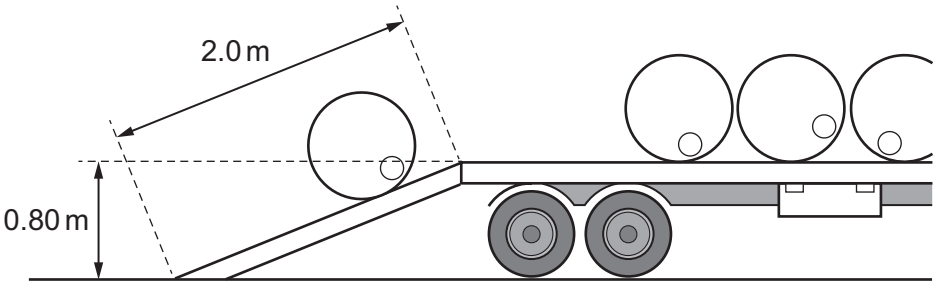
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14 A student uses an average force of F to push a box a distance of d across a horizontal table. The mass of the box is m and the gravitational field strength is g.

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** $m \times g \times d$

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

16 What is *power*?

A force per second

B the maximum force an object exerts

C the total energy of an object

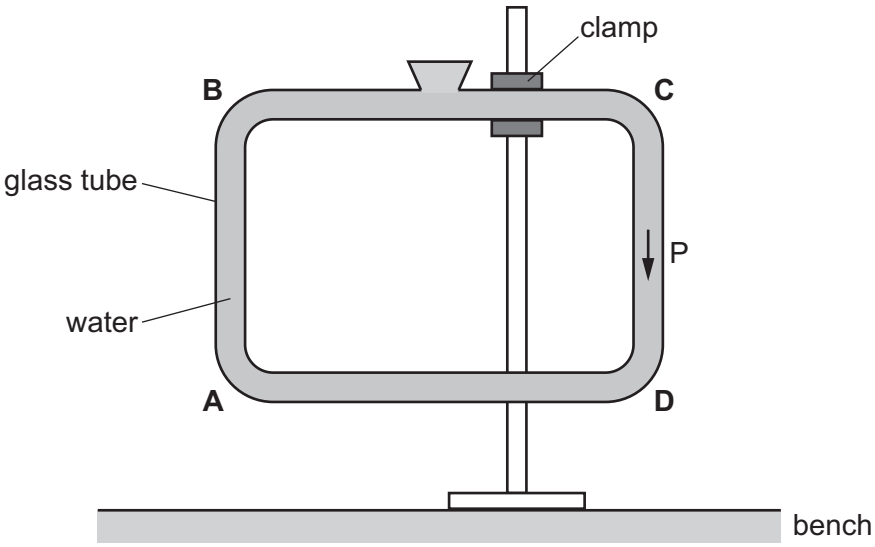
D work done per second

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17 The diagram shows a glass tube filled with water and suspended above a bench. The water is free to circulate around the tube.

At point P, there is a convection current moving in a downwards direction.

At which point is the tube heated to cause this convection current?



18 Which physical property **cannot** be used for the measurement of temperature?

A the length of a metal bar

B the mass of a plastic block

C the pressure of a gas

D the resistance of a wire

19 A student performs an experiment to find out how much energy is needed to change the temperature of a steel nail by 1.0 °C.

Which quantity is the student determining?

A the heat capacity of the nail

B the latent heat of the nail

C the specific heat capacity of steel

D the specific latent heat of steel

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20 A substance has a melting point of –17 °C and a boiling point of 117 °C.

In which state does the substance exist at –10 °C and at 110 °C?

	at –10 °C	at 110 °C
A	solid	liquid
B	solid	gas
C	liquid	liquid
D	liquid	gas

21 Which description of a liquid is correct?

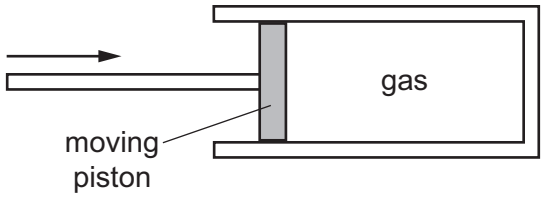
A fixed shape, fixed volume

B fixed shape, no fixed volume

C no fixed shape, fixed volume

D no fixed shape, no fixed volume

22 A mass of gas is trapped inside a cylinder by a moving piston.



As the piston moves in, the volume of the gas decreases but the temperature stays the same.

What happens to the gas pressure, and why?

	pressure	reason
A	decreases	the molecules have less room to move in the cylinder
B	decreases	the molecules move more slowly between collisions
C	increases	the molecules collide more frequently with the piston
D	unchanged	the temperature of the gas is constant

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23 A plane mirror on a vertical wall forms an image of an object placed in front of it.

Which characteristics describe the image?

A real, inverted and smaller than the object

B real, upright and the same size as the object

C virtual, upright and smaller than the object

D virtual, upright and the same size as the object

24 Which statement about light passing from air to glass is correct?

A The frequency of the light waves decreases.

B The speed of the light waves decreases.

C The wavelength of the light waves increases.

D The wavelength of the light waves remains unchanged.

25 Applications use different components of the electromagnetic spectrum.

Which shows correct applications for X-rays, ultraviolet light and microwaves?

	X-rays	ultraviolet light	microwaves
A	mobile phone	fluorescent tube	intruder alarm
B	killing cancerous cells	sterilising surgical instruments	satellite television
C	medical imaging	television controller	sunbed
D	sterilising surgical instruments	television controller	detecting cracks in metal

26 Where does sound travel the fastest?

A in a vacuum

B in gases

C in liquids

D in solids

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27 A scientific research boat uses pulses of ultrasound to detect fish underneath it.

A pulse of ultrasound is bounced from a group of fish 6000 m directly below the boat.

The next pulse is sent out 2.0 s after the echo from the previous pulse has been received.

The speed of ultrasound in water is 1500 m / s.

What is the interval between the two pulses?

A 4.0 s **B** 6.0 s **C** 8.0 s **D** 10 s

28 Which row correctly describes ultrasound?

	type of wave	frequency
A	longitudinal	less than 20 kHz
B	longitudinal	greater than 20 kHz
C	transverse	less than 20 kHz
D	transverse	greater than 20 kHz

29 What is stored in a battery and what is its unit?

	quantity	unit
A	current	A
B	current	A s
C	energy	J
D	energy	J / s

30 A car battery delivers 150 kC to a circuit before it needs recharging.

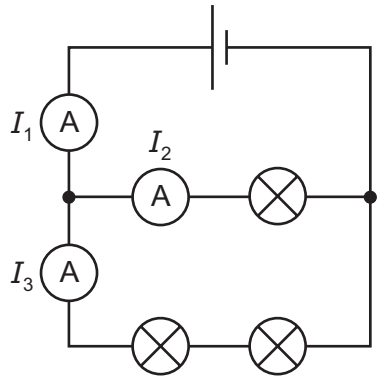
Two headlamps connected in parallel to the battery are switched on. There is a current of 4.0 A in each lamp.

How much time passes before the battery needs recharging?

A 2.6 hours **B** 5.2 hours **C** 7.8 hours **D** 10.4 hours

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31 Three identical lamps and three ammeters are connected as shown.



The readings on the ammeters are I_1, I_2 and I_3.

How are the readings related?

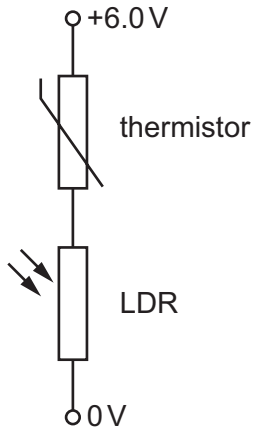
A $I_1 = I_2 = I_3$

B $I_1 > I_2$ and $I_2 = I_3$

C $I_1 > I_3 > I_2$

D $I_1 > I_2 > I_3$

32 A thermistor and a light-dependent resistor (LDR) are connected in series. A potential difference (p.d.) of 6.0 V is applied across them as shown.



The thermistor has a resistance of 6000 Ω in a cold room and 1000 Ω in a warm room. The LDR has a resistance of 2000 Ω in dim light and 500 Ω in bright light.

When is the p.d. across the LDR equal to 2.0 V?

A in a cold room with bright light

B in a cold room with dim light

C in a warm room with bright light

D in a warm room with dim light

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33 A 240 V mains circuit contains eight 60 W lamps in parallel. At the time when the lamps are switched on, the filaments are cold and the current is four times as large as the final steady current in the circuit.

What is the initial current supplied by the mains?

A 0.25 A **B** 1.0 A **C** 2.0 A **D** 8.0 A

34 What is used with a magnet to create an induced electromotive force (e.m.f.) in a simple a.c. generator?

A a battery

B a coil of wire

C a voltmeter

D a relay

35 What changes kinetic (movement) energy into electrical energy?

A a car battery

B an electric fire

C an electric motor

D a wind turbine

36 A transformer has 4800 turns on its primary coil and 480 turns on its secondary coil.

The primary coil is connected to a 240 V a.c. supply. The secondary coil is connected to a lamp.

How does the output current in the lamp compare with the input current?

A higher frequency a.c.

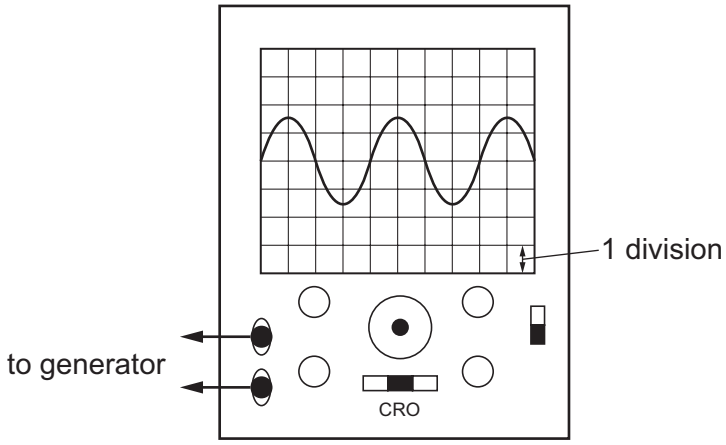
B lower frequency a.c.

C current in one direction only

D the same frequency a.c.

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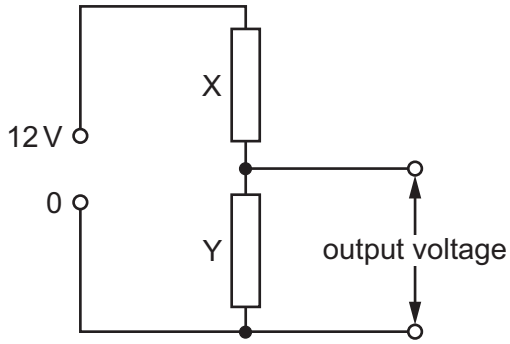
37 A cathode-ray oscilloscope with the Y-gain set at 2 V / division is connected to a generator.



Which row describes the signal from the generator and its amplitude?

	signal	amplitude / V
A	a.c.	3
B	a.c.	6
C	d.c.	3
D	d.c.	6

38 A potential divider uses a power supply of voltage 12 V. The resistors X and Y initially have equal resistances.



The resistance of X is halved.

What is the change in the output voltage?

A –3.0 V **B** –2.0 V **C** +2.0 V **D** +3.0 V

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39 What is the definition of the half-life of a radioactive element?

A half of the time it takes for one atom to decay

B half of the time taken for all the atoms in a sample to decay

C the time taken for half of the atoms in a sample to decay

D the time taken for the nucleon number (mass number) to halve

40 Which row shows the atomic structure of a neutral atom with a nucleon number of 9?

	number of neutrons	number of protons	number of electrons
A	4	5	4
B	4	5	5
C	5	4	5
D	5	5	4

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