National Qualifications 2016

X757/75/02

Physics
Section 1 — Questions

TUESDAY, 24 MAY

1:00 PM – 3:00 PM

Instructions for the completion of Section 1 are given on *Page 02* of your question and answer booklet X757/75/01.

Record your answers on the answer grid on *Page 03* of your question and answer booklet

Reference may be made to the Data Sheet on *Page 02* of this booklet and to the Relationships Sheet X757/75/11.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

DATA SHEET

Speed of light in materials

Material	*Speed* in $m\,s^{-1}$
Air	$3{\cdot}0 \times 10^8$
Carbon dioxide	$3{\cdot}0 \times 10^8$
Diamond	$1{\cdot}2 \times 10^8$
Glass	$2{\cdot}0 \times 10^8$
Glycerol	$2{\cdot}1 \times 10^8$
Water	$2{\cdot}3 \times 10^8$

Gravitational field strengths

	Gravitational field strength on the surface in $N\,kg^{-1}$
Earth	9·8
Jupiter	23
Mars	3·7
Mercury	3·7
Moon	1·6
Neptune	11
Saturn	9·0
Sun	270
Uranus	8·7
Venus	8·9

Specific latent heat of fusion of materials

Material	*Specific latent heat of fusion* in $J\,kg^{-1}$
Alcohol	$0{\cdot}99 \times 10^5$
Aluminium	$3{\cdot}95 \times 10^5$
Carbon Dioxide	$1{\cdot}80 \times 10^5$
Copper	$2{\cdot}05 \times 10^5$
Iron	$2{\cdot}67 \times 10^5$
Lead	$0{\cdot}25 \times 10^5$
Water	$3{\cdot}34 \times 10^5$

Specific latent heat of vaporisation of materials

Material	*Specific latent heat of vaporisation* in $J\,kg^{-1}$
Alcohol	$11{\cdot}2 \times 10^5$
Carbon Dioxide	$3{\cdot}77 \times 10^5$
Glycerol	$8{\cdot}30 \times 10^5$
Turpentine	$2{\cdot}90 \times 10^5$
Water	$22{\cdot}6 \times 10^5$

Speed of sound in materials

Material	*Speed* in $m\,s^{-1}$
Aluminium	5200
Air	340
Bone	4100
Carbon dioxide	270
Glycerol	1900
Muscle	1600
Steel	5200
Tissue	1500
Water	1500

Specific heat capacity of materials

Material	*Specific heat capacity* in $J\,kg^{-1}\,°C^{-1}$
Alcohol	2350
Aluminium	902
Copper	386
Glass	500
Ice	2100
Iron	480
Lead	128
Oil	2130
Water	4180

Melting and boiling points of materials

Material	*Melting point* in °C	*Boiling point* in °C
Alcohol	−98	65
Aluminium	660	2470
Copper	1077	2567
Glycerol	18	290
Lead	328	1737
Iron	1537	2737

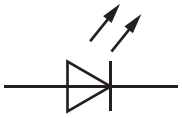
Radiation weighting factors

Type of radiation	*Radiation weighting factor*
alpha	20
beta	1
fast neutrons	10
gamma	1
slow neutrons	3
X-rays	1

SECTION 1

Attempt ALL questions

1. The symbol for an electronic component is shown.



This is the symbol for

A an LDR

B a transistor

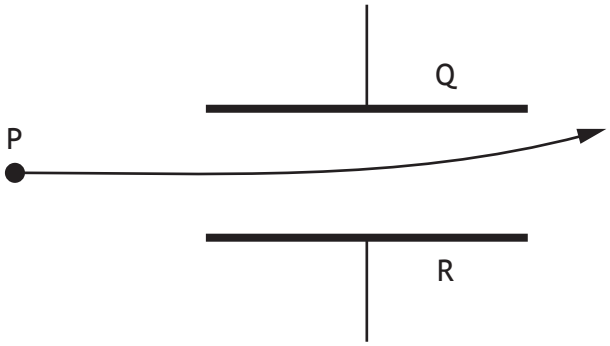
C an LED

D a photovoltaic cell

E a thermistor.

2. A uniform electric field exists between plates Q and R.

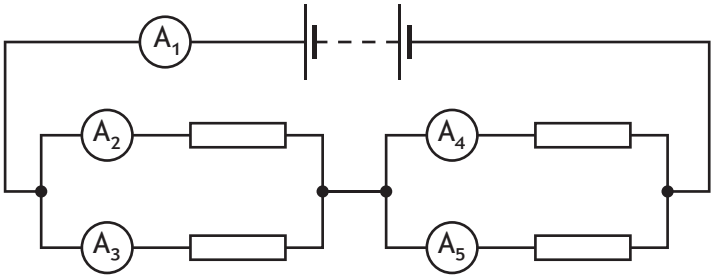
The diagram shows the path taken by a particle as it passes through the field.



Which row in the table identifies the charge on the particle, the charge on plate Q and the charge on plate R?

	Charge on particle	*Charge on plate Q*	*Charge on plate R*
A	negative	positive	negative
B	negative	negative	positive
C	no charge	negative	positive
D	no charge	positive	negative
E	positive	positive	negative

3. A circuit is set up as shown.



The reading on ammeter A_1 is 5·0 A.

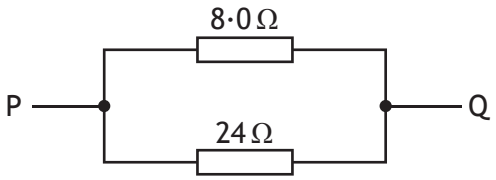
The reading on ammeter A_2 is 2·0 A.

The reading on ammeter A_4 is 1·0 A.

Which row in the table shows the reading on ammeters A_3 and A_5?

	Reading on ammeter A_3 (A)	*Reading on ammeter A_5* (A)
A	2·0	1·0
B	3·0	1·0
C	2·0	4·0
D	3·0	4·0
E	5·0	5·0

4. Two resistors are connected as shown.



The total resistance between P and Q is

A 0·17 Ω

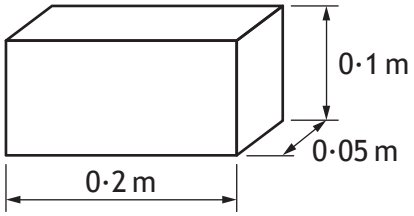
B 3·0 Ω

C 6·0 Ω

D 16 Ω

E 32 Ω.

5. A block has the dimensions shown.



The block is placed so that one of the surfaces is in contact with a smooth table top.

The weight of the block is 4·90 N.

The **minimum** pressure exerted by the block on the table top is

A 25 Pa

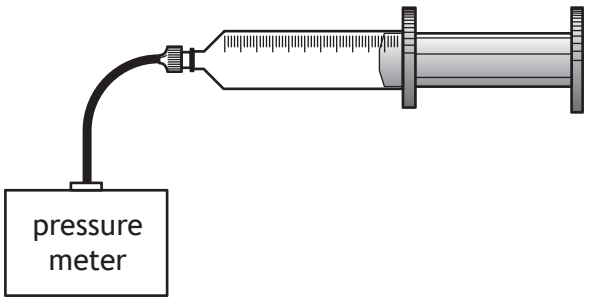
B 245 Pa

C 490 Pa

D 980 Pa

E 4900 Pa.

6. A syringe is connected to a pressure meter as shown.



The syringe contains a fixed mass of air of volume 150 mm^3.

The reading on the pressure meter is 120 kPa.

The volume of air inside the syringe is now changed to 100 mm^3.

The temperature of the air in the syringe remains constant.

The reading on the pressure meter is now

A 80 kPa

B 125 kPa

C 180 kPa

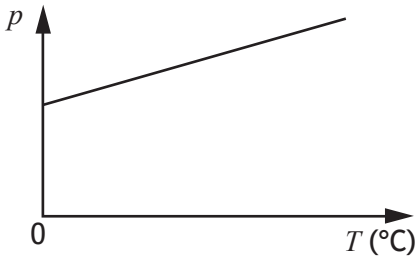
D 80 000 kPa

E 180 000 kPa.

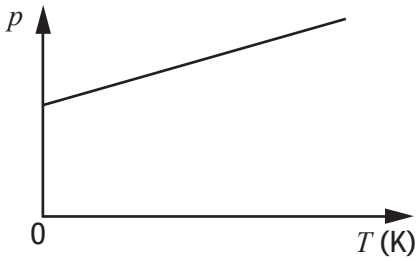
7. A sample of an ideal gas is enclosed in a sealed container.

Which graph shows how the pressure p of the gas varies with the temperature T of the gas?

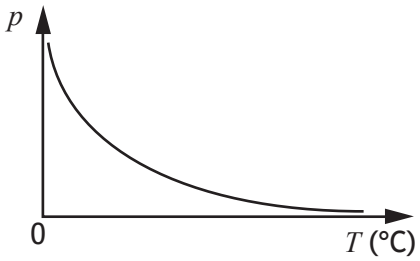
A



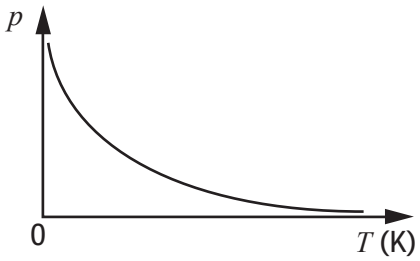
B



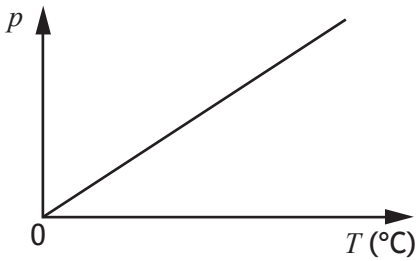
C



D



E



8. A student makes the following statements about waves.

I Waves transfer energy.

II A wave with a short wavelength diffracts more than a wave with a long wavelength.

III The amplitude of a wave depends on its wavelength.

Which of these statements is/are correct?

A I only

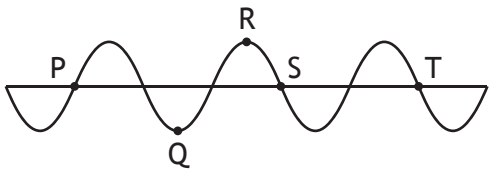
B II only

C III only

D I and II only

E I and III only

9. The diagram represents a wave.



The wavelength of the wave is the horizontal distance between points

A P and Q

B P and S

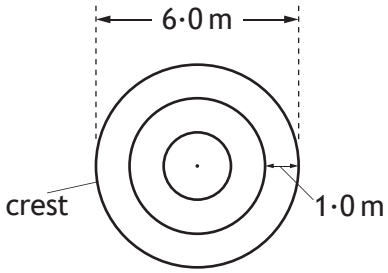
C Q and R

D R and S

E S and T.

[Turn over

10. The diagram represents the position of the crests of waves 3 seconds after a stone is thrown into a pool of still water.



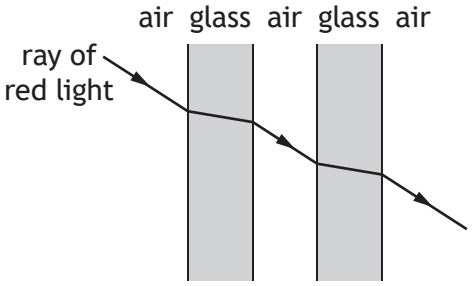
Which row in the table shows the speed and the frequency of the waves?

	Speed ($m\ s^{-1}$)	*Frequency* (Hz)
A	0·33	3
B	0·33	1
C	1·0	1
D	1·0	3
E	1·0	4

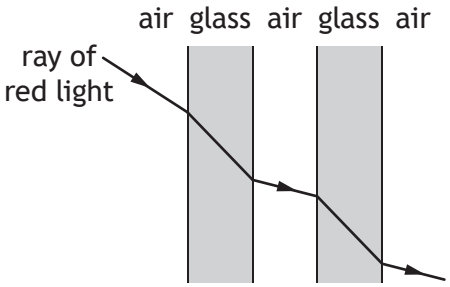
11. A ray of red light passes through a double glazed window.

Which diagram shows the path of the ray as it passes through the window?

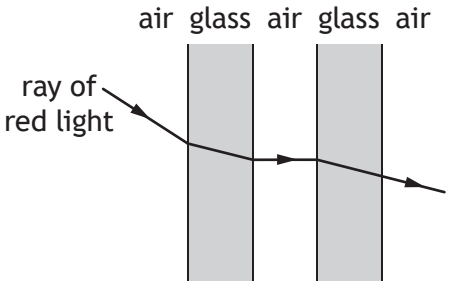
A



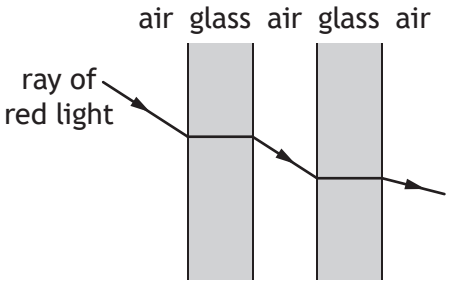
B



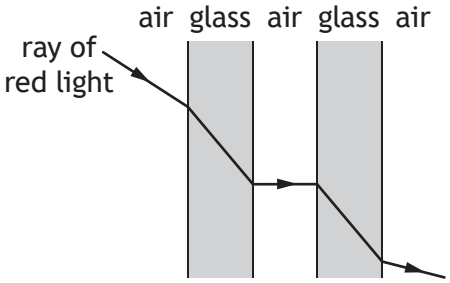
C



D



E



[Turn over

12. Which row in the table shows how the mass and charge of an alpha particle compares to the mass and charge of a beta particle?

	Mass of an alpha particle compared to mass of a beta particle	*Charge on an alpha particle compared to charge on a beta particle*
A	larger	same
B	larger	opposite
C	same	same
D	smaller	opposite
E	smaller	same

13. During ionisation an atom becomes a positive ion.

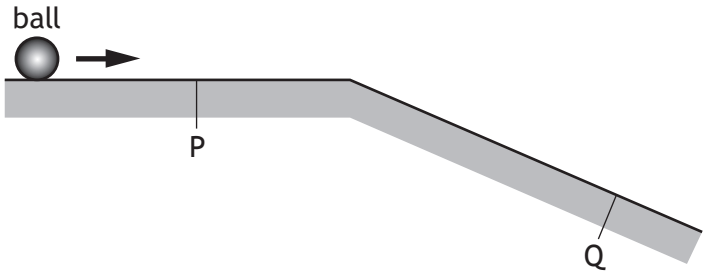
Which of the following has been removed from the atom?

A An alpha particle
B An electron
C A gamma ray
D A neutron
E A proton

14. Which of the following is a vector quantity?

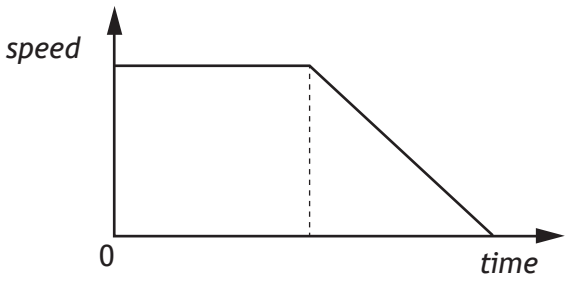
A Mass
B Time
C Speed
D Kinetic energy
E Acceleration

15. A ball moves along a horizontal frictionless surface and down a slope as shown.

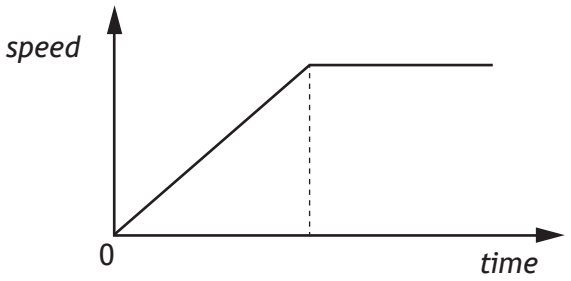


Which of the following graphs shows how the speed of the ball varies with time as it travels from P to Q?

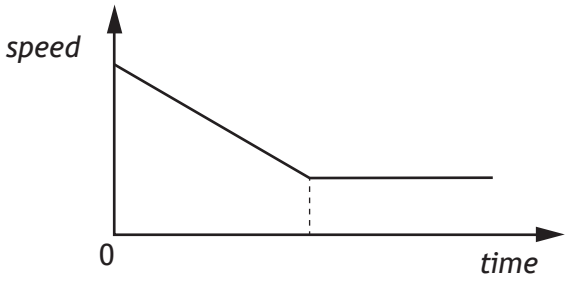
A



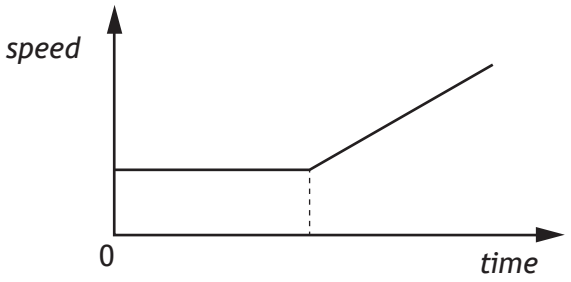
B



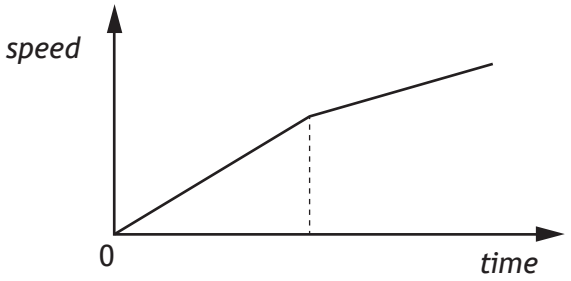
C



D



E



16. A cyclist is travelling at 10 m s^{-1} along a level road.

The cyclist applies the brakes and comes to rest in a time of 5 s.

The combined mass of the cycle and cyclist is 80 kg.

The maximum energy converted to heat by the brakes is

A 160 J

B 400 J

C 800 J

D 4000 J

E 8000 J.

17. A rocket is taking off from the surface of the Earth. The rocket engines exert a force on the exhaust gases.

Which of the following is the reaction to this force?

A The force of the Earth on the exhaust gases.

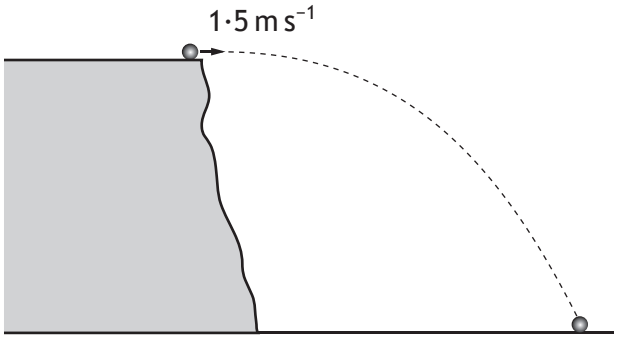
B The force of the Earth on the rocket engines.

C The force of the rocket engines on the Earth.

D The force of the exhaust gases on the Earth.

E The force of the exhaust gases on the rocket engines.

18. A ball is projected horizontally with a velocity of $1{\cdot}5\ m\ s^{-1}$ from a cliff as shown.



The ball hits the ground 1·2 s after it leaves the cliff.

The effects of air resistance are negligible.

Which row in the table shows the horizontal velocity and vertical velocity of the ball just before it hits the ground?

	Horizontal velocity ($m\ s^{-1}$)	*Vertical velocity* ($m\ s^{-1}$)
A	12	12
B	12	1·5
C	1·5	12
D	1·5	13
E	0	12

19. The minimum amount of energy required to change 0·5 kg of water at its boiling point into steam at the same temperature is

A $2{\cdot}09 \times 10^3$ J

B $1{\cdot}67 \times 10^5$ J

C $3{\cdot}34 \times 10^5$ J

D $1{\cdot}13 \times 10^6$ J

E $2{\cdot}26 \times 10^6$ J.

[Turn over for next question

20. A student makes the following statements about the Universe.

I The Big Bang Theory is a theory about the origin of the Universe.

II The Universe is approximately 14 million years old.

III The Universe is expanding.

Which of these statements is/are correct?

A I only

B II only

C I and II only

D I and III only

E I, II and III.

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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