

ELECTRICITY

Practice Exam Questions

Physics Section 1—Questions

Speed of light in materials

Material	Speed in m s ⁻¹
Air	$3.0 imes 10^8$
Carbon dioxide	$3.0 imes 10^8$
Diamond	1·2 × 10 ⁸
Glass	2.0×10^8
Glycerol	2·1 × 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 Jkg ⁻¹
Alcohol	0·99 × 10 ⁵
Aluminium	3∙95 × 10 ⁵
Carbon Dioxide	$1.80 imes 10^5$
Copper	2.05×10^5
Iron	$2 \cdot 67 imes 10^5$
Lead	0.25×10^5
Water	$3 \cdot 34 imes 10^5$

Specific latent heat of vaporisation of materials

Material	Specific latent heat of vaporisation in J kg ⁻¹
Alcohol	11·2 × 10 ⁵
Carbon Dioxide	3.77×10^5
Glycerol	$8\cdot 30 imes 10^5$
Turpentine	$2 \cdot 90 imes 10^5$
Water	22.6 × 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
lce	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	

- 1. The voltage of an electrical supply is a measure of the
 - A resistance of the circuit
 - B speed of the charges in the circuit
 - C power developed in the circuit
 - D energy given to the charges in the circuit
 - E current in the circuit.
- 2. Four circuit symbols, W, X, Y and Z, are shown.



Which row identifies the components represented by these symbols?

	W	X	Y	Z
А	battery	ammeter	resistor	variable resistor
В	battery	ammeter	fuse	resistor
C	lamp	ammeter	variable resistor	resistor
D	lamp	voltmeter	resistor	fuse
Е	lamp	voltmeter	variable resistor	fuse

3. A student suspects that ammeter A_1 may be inaccurate. Ammeter A_2 is known to be accurate.

Which of the following circuits should be used to compare the reading on A_1 with A_2 ?



1. Two circuits are set up as shown.



Both circuits are used to determine the resistance of resistor R. Which row in the table identifies meter X, meter Y and meter Z?

	meter X	meter Y	meter Z
А	ohmmeter	voltmeter	ammeter
В	ohmmeter	ammeter	voltmeter
С	voltmeter	ammeter	ohmmeter
D	ammeter	voltmeter	ohmmeter
E	voltmeter	ohmmeter	ammeter

- 2. Which of the following statements is/are correct?
 - I The voltage of a battery is the number of joules of energy it gives to each coulomb of charge.
 - II A battery only has a voltage when it is connected in a complete circuit.
 - III Electrons are free to move within an insulator.
 - A I only
 - B II only
 - C III only
 - D II and III only
 - E I, II and III



The resistance between X and Y is

- Α 1.3Ω
- B 4·5Ω
- **C** 6.0 Ω
- **D** 8.0Ω
- E 12 Ω.
- 4. The rating plate on an electrical appliance is shown.



The resistance of this appliance is

- A 0.017 Ω
- B 0·25 Ω
- **C** 4·0 Ω
- D 18·4Ω
- E 57·5 Ω.

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
А	negative	positive	negative
В	negative	negative	positive
С	no charge	negative	positive
D	no charge	positive	negative
Е	positive	positive	negative



The reading on ammeter A_1 is $5{\cdot}0\,A.$

The reading on ammeter A_2 is $2{\cdot}0\,A.$

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)
А	2.0	1.0
В	3.0	1.0
С	2.0	4.0
D	3.0	4.0
Е	5.0	5.0

4. Two resistors are connected as shown.



The total resistance between P and Q is

- **A** 0·17 Ω
- B 3.0Ω
- **C** 6·0 Ω
- D 16 Ω
- Ε 32 Ω.



The reading on ammeter A_1 is 5.0 A. The reading on ammeter A_2 is 2.0 A. The charge passing through the lamp in 30 seconds is

- A 0.1 C
- B 10C
- C 60 C
- D 90 C
- E 150 C.
- 3. A lamp is connected to a constant voltage power supply. The power supply is switched on. The graph shows how the current in the lamp varies with time.



Which row in the table shows what happens to the current and resistance of the lamp between 0.05 s and 0.45 s?

	Current	Resistance
Α	decreases	increases
В	decreases	stays the same
С	stays the same	decreases
D	increases	decreases
E	increases	increases



The purpose of the transistor is to

- A supply energy to the circuit
- B decrease the voltage across R₁
- C change electrical energy to kinetic energy
- D supply energy to the motor
- E switch on the motor.



ELECTRICITY

Practice Questions

Physics Section 2

MARKS DO NOT WRITE IN THIS MARGIN

1. A toy car contains an electric circuit which consists of a 12.0V battery, an electric motor and two lamps.



The circuit diagram is shown.



(a) Switch 1 is now closed.Calculate the power dissipated in the motor when operating.Space for working and answer

1.	(continued)	MARKS	DO NOT WRITE IN THIS MARGIN
	(b) Switch 2 is now also closed.		
	(i) Calculate the total resistance of the motor and the two Space for working and answer	lamps. 3	
	(ii) One of the lamps now develops a fault and stops workinState the effect this has on the other lamp.	g.	
	You must justify your answer.	2	
		iotai marks 8	
		[Turn over	

MARKS d DO NOT WRITE IN THIS MARGIN

2. A thermistor is used as a temperature sensor in a circuit to monitor and control the temperature of water in a tank. Part of the circuit is shown.



(a) (i) The variable resistor R is set at a resistance of 1050 Ω.
 Calculate the resistance of the thermistor when the voltage across the thermistor is 2.0 V.
 Space for working and answer



Use the graph to determine the temperature of the water when the voltage across the thermistor is $2 \cdot 0 V$.



1. A student sets up the following circuit using a battery, two lamps, a switch and a resistor.



(a) Draw a circuit diagram for this circuit using the correct symbols for the components.

(b) Each lamp is rated 2.5 V, 0.50 A.

Calculate the resistance of one of the lamps when it is operating at the correct voltage.

Space for working and answer

3

3

MARKS DO NOT WRITE IN THIS MARGIN







1. Electrical storms occur throughout the world.



During one lightning strike 24C of charge is transferred to the ground in $0{\cdot}0012\,s.$

(a) Calculate the average current during the lightning strike.Space for working and answer

3

(b) The charge on an electron is -1.6×10^{-19} C. Determine the number of electrons transferred during the lightning strike.

Space for working and answer

1. (continued)

(c) Many tall buildings have a thick strip of metal attached to the side of the building.



This strip is used to protect the building from damage during electrical storms.

Explain how this strip protects the building from damage.

1

1

2. A student investigates the resistance of a resistor using the circuit shown.



- (a) Complete the circuit diagram to show where a voltmeter must be connected to measure the voltage across resistor R.
 (An additional diagram, if required, can be found on Page 33.)
- (b) Describe how the student obtains a range of values of voltage and current.

2. (continued)

(c) The results of the student's investigation are shown.

Voltage across resistor R (V)	Current in resistor R (A)
1.0	0.20
2.5	0.50
3.2	0.64
6.2	1.24

Use **all** these results to determine the resistance of resistor R. *Space for working and answer*

(d) The student now replaces resistor R with a filament lamp and repeats the investigation. A sketch graph of the student's results is shown.



State a conclusion that can be made about the resistance of the filament lamp.

	N	MARKS	DO NOT WRITE IN THIS
			MARGIN
1.	The rating plate on a food blender is shown.		
	Model: FB67P		
	230 V a.c. 50 Hz		
	290 W		
	(a) The plugs on all modern electrical appliances in the UK are fitted with fuses rated at either 3 A or 13 A.		
	(i) Draw the circuit symbol for a fuse.	1	
	(ii) State the purpose of the fuse fitted in the plug of an appliance.	1	
	(iii) Determine the rating of the fuse fitted in the plug of the blender.		
	Justify your answer by calculation.	4	
	Space for working and answer		

			MARKS	DO NOT WRITE IN THIS
1.	(cor		MARGIN	
	(b)	The blender is connected to an alternating current (a.c.) supply.		
		Explain in terms of electron flow what is meant by <i>alternating current</i> .	1	

MARKS DO NOT WRITE IN THIS MARGIN

4

3

2. A student sets up the following circuit.



- (a) The student closes switch S1.
 - (i) Calculate the voltage across the motor. Space for working and answer

(ii) Calculate the power dissipated in the motor.Space for working and answer

				MARKS	DO NOT WRITE IN THIS
2.	(continued)			MARGIN	
	(b) The student now also closes switch S2.				
		(i)	Calculate the combined resistance of the two resistors. Space for working and answer	3	
		(ii)	State the effect that closing switch S2 has on the power dissipated in the motor.	2	
			Justify your answer.	2	



Physics Relationships Sheet

$$E_p = mgh$$
 $d = vt$

$$E_k = \frac{1}{2}mv^2 \qquad \qquad v = f\lambda$$

$$Q = It T = \frac{1}{f}$$

$$V = IR$$

$$A = \frac{N}{2}$$

$$R_T = R_1 + R_2 + \dots \qquad \qquad A = -\frac{1}{t}$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots \qquad D = \frac{E}{m}$$

$$V_2 = \left(\frac{R_2}{R_1 + R_2}\right) V_s \qquad \qquad H = Dw_R$$
$$\dot{H} = \frac{H}{H}$$

$$\frac{V_1}{V_2} = \frac{R_1}{R_2} \qquad \qquad t \qquad \qquad s = vt$$

$$P = \frac{E}{t} \qquad \qquad d = \overline{vt}$$

$$P = IV$$

$$P = I^2 R \qquad \qquad a = \frac{v - u}{t}$$

$$P = \frac{V^2}{R} \qquad \qquad W = mg$$
$$F = ma$$

$$E_h = cm \Delta T \qquad \qquad E_w = Fd$$

$$p = \frac{F}{A} \qquad \qquad E_h = ml$$

$$\frac{pV}{T} = \text{constant}$$
$$p_1 V_1 = p_2 V_2$$

$$\frac{p_1}{T_1} = \frac{p_2}{T_2}$$
$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\overline{T_1} - \overline{T_2}$$

Additional Relationships

Circle

circumference = $2\pi r$

area = πr^2

Sphere

area = $4\pi r^2$

volume = $\frac{4}{3}\pi r^3$

Trigonometry

 $\sin \Theta = \frac{\text{opposite}}{\text{hypotenuse}}$

 $\cos \Theta = \frac{\text{adjacent}}{\text{hypotenuse}}$

 $\tan \Theta = \frac{\text{opposite}}{\text{adjacent}}$

 $\sin^2\theta + \cos^2\theta = 1$

	87 Fr 2,8,18,32, 18,8,1 Francium	55 Cs 2,8,18,18, 8,1 Caesium	Rb 2,8,18,8,1 Rubidium	Potassium 37	2,8,8,1	₹ 3	Sodium	2,8,1	Na	11	<u>ک</u> , ۱	, -	ω	1 Hydrogen	エ →	(1)	Group 1
Lar	88 Ra 2,8,18,32, 18,8,2 Radium	56 Ba 2,8,18,18, 8,2 Barium	Sr 2,8,18,8,2 Strontium	Calcium 38	2,8,8,2	20 Ca	Magnesium	2,8,2	Mg	17	۲,۲ Bondlium	р Ве	4	(2)			Group 2
nthanides	89 Ac 2,8,18,32, 18,9,2 Actinium	57 La 2,8,18,18, 9,2 Lanthanum	Y 2,8,18,9,2 Yttrium	Scandium 39	2,8,9,2	21 Sc	(3)										
57 La 2,8,18, 18,9,2 Lanthanum	104 Rf 2,8,18,32, 32,10,2 Rutherfordium	72 Hf 2,8,18,32, 10,2 Hafnium	Zr 2,8,18, 10,2 Zirconium	Titanium 40	2,8,10,2	22 Ti	(4)								Key		
58 Ce 2,8,18, 20,8,2 Cerium	105 Db 2,8,18,32, 32,11,2 Dubnium	73 Ta 2,8,18, 32,11,2 Tantalum	Nb 2,8,18, 12,1 Niobium	Vanadium 41	2,8,11,2	< 23	(5)							Flectr	Ato		
59 Pr 2,8,18,21, 8,2 Praseodymium	106 Sg 2,8,18,32, 32,12,2 Seaborgium	74 W 2,8,18,32, 12,2 Tungsten	No 2,8,18,13, 1 Molybdenum	Chromium 42	2,8,13,1	24 Cr	(6)					Name		Symbol	omic num		
60 Nd 2,8,18,22, 8,2 Neodymium	107 Bh 2,8,18,32, 32,13,2 Bohrium	75 Re 2,8,18,32, 13,2 Rhenium	Tc 2,8,18,13, 2 Technetium	Manganese 43	2,8,13,2	25 Mn	(7)		I ransition					ement	ber		
61 Pm 2,8,18,23, 8,2 Promethium	108 Hs 2,8,18,32, 32,14,2 Hassium	76 Os 2,8,18,32, 14,2 Osmium	Ru 2,8,18,15, 1 Ruthenium	Iron 44	2,8,14,2	26 Fe	(8)		Element								
62 Sm 2,8,18,24, 8,2 Samarium	109 Mt 2,8,18,32, 32,15,2 Meitnerium	77 Ir 2,8,18,32, 15,2 Iridium	Rh 2,8,18,16, 1 Rhodium	Cobalt 45	2,8,15,2	27 Co	(9)		S								
63 Eu 2,8,18,25, 8,2 Europium	110 Ds 2,8,18,32, 32,17,1 Darmstadtium	78 Pt 2,8,18,32, 17,1 Platinum	Pd 2,8,18, 18,0 Palladium	Nickel 46	2,8,16,2	28 Ni	(10)										
64 Gd 2,8,18,25, 9,2 Gadolinium	111 Rg 2,8,18,32, 32,18,1 Roentgenium	79 Au 2,8,18, 32,18,1 Gold	Ag 2,8,18, 18,1 Silver	Copper 47	2,8,18,1	29 Cu	(11)										
65 Tb 2,8,18,27, 8,2 Terbium	112 Cn 2,8,18,32, 32,18,2 Copernicium	80 Hg 2,8,18, 32,18,2 Mercury	Cd 2,8,18, 18,2 Cadmium	Zinc 48	2,8,18,2	30 Zn	(12)										
66 Dy 2,8,18,28, 8,2 Dysprosium		81 Tl 2,8,18, 32,18,3 Thallium	In 2,8,18, 18,3 Indium	Gallium 49	2,8,18,	31 Ga	Aluminiu	2,8,3	Þ t	13	2,3	, σ	ე თ	(13)			Group
67 Ho 2,8,18,29, 8,2 Holmium		82 Pb 2,8,18, 32,18,4 1 Lead	2,8,18, 18,4 Tin	Germaniu 50	3 2,8,18,	32 Ge	m Silicon	2,8,4	Si	14	2,4	<u>ر</u> ر) 0	(14)			3 Group
68 Er 2,8,18,30, 8,2 Erbium		83 Bi 2,8,18, 32,18,5 Bismuth	Sb 2,8,18, 18,5 Antimony	m Arsenic 51	4 2,8,18,5	33 As	Phosphoru	2,8,5	ק ק	11	L, J	, z	7	(15)			4 Group 5
69 Tm 2,8,18,31, 8,2 Thulium		84 Po 2,8,18, 32,18,6 Polonium	Te 2,8,18, 18,6 / Tellurium	Selenium 52	5 2,8,18,6	34 Se	ıs Sulfur	2,8,6	s S		,o	; c)∞	(16)			Group (
70 Yb 2,8,18,32, 8,2 Ytterbium		85 At 2,8,18, 32,18,7 Astatine	L 2,8,18, 18,7 Iodine	Bromine 53	2,8,18,7	Br 35	Chlorine	2,8,7	<u></u> 0 :	17	L,/	, -	1 0	(17)			Group 7
71 Lu 2,8,18,32, 9,2 Lutetium		86 Rn 2,8,18, 32,18,8 Radon	Xe 2,8,18, 18,8 Xenon	Krypton 54	7 2,8,18,8	<mark>ች</mark> 36	Argon	2,8,8	Ar a	18	Z,ð	, NG	10	2 Helium	2 He	(18)	7 Group 0
	57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu 2,8,18, 18, 21 2,8,18, 20, 8,2 2,8,18,21 2,8,18,22 2,8,18,22 2,8,18,23 2,8,18,23 2,8,18,25 2,8,18,25 2,8,18,25 2,8,18,27 2,8,18,27 2,8,18,29 2,8,18,30 2,8,18,30 2,8,18,31 2,8,18,32 9,2 9,2 9,2 8,2 8,2 8,2 9,2 8,18,27 2,8,18,27 2,8,18,27 2,8,18,27 2,8,18,28 2,8,18,30 2,8,18,32 9,2 8,2 9,2 8,2 8,2 8,2 9,2 8,2 8,2 8,2 8,2 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,18 9,2 8,2 8,2 8,2 8,2 8,2 9,2 8,2 9,2 8,2	87 88 89 104 105 106 107 108 109 110 111 112 Fr Ra Ac Rf Db Sg Bh Hs Mt Ds Rg Cn 2,8,18,32, 18,8,12 2,8,18,32, 18,8,2 2,8,18,32, 2,8,18,32, 2,8,18,32, 2,8,18,32, 32,11,2 2,8,18,32, 32,12,2 2,8,18,32, 32,13,2 2,8,18,32, 32,14,2 2,8,18,32, 32,14,2 2,8,18,32, 32,17,1 2,8,18,32, 32,17,1 2,8,18,32, 32,17,1 2,8,18,32, 32,17,1 2,8,18,32, 32,17,1 2,8,18,32, 32,18,1 2,8,18,32, 32,18,2 2,8,18,32, 32,18,1 2,8,18,32, 32,17,1 2,8,18,32, 32,17,1 2,8,18,32, 32,18,1 2,8,18,32, 32,18,2 2,8,18,32, 32,18,1 2,8,18,32, 32,18,1 2,8,18,32, 32,18,2 2,8,18,32, 32,18,1 2,8,18,32, 32,18,2 2,8,18,32, 32,18,1 2,8,18,32, 32,18,2 2,8,18,32, 32,18,2 2,8,18,32, 32,18,2 2,8,18,32, 32,18,2 2,8,18,25, 8,2 2,8,18,25, 8,2 2,8,18,25, 8,2 2,8,18,25, 8,2 2,8,18,26, 8,2 2,8,18,31, 8,2 2,8,18,31, 8,2 2,8,18,32, 8,2 2,8,18,32, 8,2 2,8,18,25, 8,2 2,8,18,25, 8,2 2,8,18,25, 8,2 2,8,18,25, 8,2	55 56 57 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 2.8 18.1 2.8,16,18 2.8,16,18 2.8,16,18 2.8,18,1	Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe 2.8.18.8,1 2.8.18.9,2 2.8.18.9,2 2.8.18.9,2 2.8.18.9,2 2.8.18.13			19 20 21 22 23 24 25 26 27 28 29 30 31 34 35 36 37 28,81 2,8,81 2,8,81 2,8,81 2,8,12 2,8,113 2,8,112 2,8,113 2,8,112 2,8,113	Sadum Magnesium (3) (4) (5) (6) (7) (8) (9) (10) (11) (2) (2) (3) <	2,8,1 2,8,2 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) </td <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>$\begin{array}{c c c c c c c c c c c c c c c c c c c$</td> <td>Intrim Regularin Transition Elements Signal Signal</td> <td>1 3 4 Name Name 5 6 7 8 6 7 8 9 10 11 12 2.2 1 1 1 1 1 1 2.3 2.4 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.</td> <td>ImageSimpl</td> <td>H Come number Symbol Symbol Symbol Symbol H Symbol H H Symbol H</td> <td>$(i) \ (i)$</td>	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Intrim Regularin Transition Elements Signal Signal	1 3 4 Name Name 5 6 7 8 6 7 8 9 10 11 12 2.2 1 1 1 1 1 1 2.3 2.4 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.	ImageSimpl	H Come number Symbol Symbol Symbol Symbol H Symbol H H Symbol H	$ (i) \ (i)$

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Electron Arrangements of Elements