

Exam Question Practice

Section 1 – Multiple Choice Questions for UNIT 2 - ELECTRICITY

DATA SHEET

COMMON PHYSICAL QUANTITIES

Quantity	Symbol	Value	Quantity	Symbol	Value
Speed of light in vacuum	c	$3.00 \times 10^8 \text{ m s}^{-1}$	Planck's constant	h	$6.63 \times 10^{-34} \text{ J s}$
Magnitude of the charge on an electron	e	$1.60 \times 10^{-19} \text{ C}$	Mass of electron	m_e	$9.11 \times 10^{-31} \text{ kg}$
Universal Constant of Gravitation	G	$6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$	Mass of neutron	m_n	$1.675 \times 10^{-27} \text{ kg}$
Gravitational acceleration on Earth	g	9.8 m s^{-2}	Mass of proton	m_p	$1.673 \times 10^{-27} \text{ kg}$
Hubble's constant	H_0	$2.3 \times 10^{-18} \text{ s}^{-1}$			

REFRACTIVE INDICES

The refractive indices refer to sodium light of wavelength 589 nm and to substances at a temperature of 273 K.

Substance	Refractive index	Substance	Refractive index
Diamond	2.42	Water	1.33
Crown glass	1.50	Air	1.00

SPECTRAL LINES

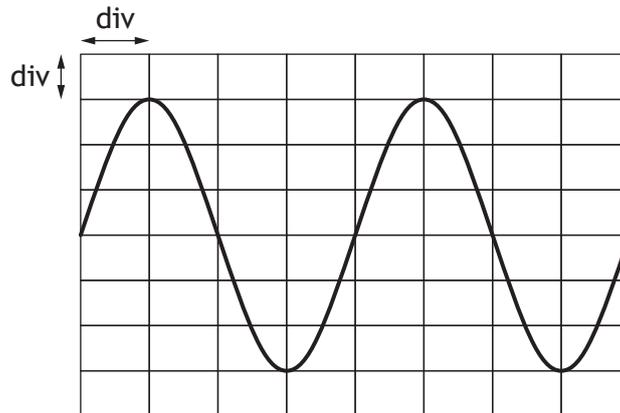
Element	Wavelength/nm	Colour	Element	Wavelength/nm	Colour
Hydrogen	656	Red	Cadmium	644	Red
	486	Blue-green		509	Green
	434	Blue-violet		480	Blue
	410	Violet	Lasers		
	397	Ultraviolet	<i>Element</i>	<i>Wavelength/nm</i>	<i>Colour</i>
	389	Ultraviolet	Carbon dioxide	9550 } 10590 }	Infrared
Sodium	589	Yellow	Helium-neon	633	Red

PROPERTIES OF SELECTED MATERIALS

Substance	Density/kg m ⁻³	Melting Point/K	Boiling Point/K
Aluminium	2.70×10^3	933	2623
Copper	8.96×10^3	1357	2853
Ice	9.20×10^2	273
Sea Water	1.02×10^3	264	377
Water	1.00×10^3	273	373
Air	1.29
Hydrogen	9.0×10^{-2}	14	20

The gas densities refer to a temperature of 273 K and a pressure of $1.01 \times 10^5 \text{ Pa}$.

16. The output from an a.c. power supply is connected to an oscilloscope. The trace seen on the oscilloscope screen is shown.



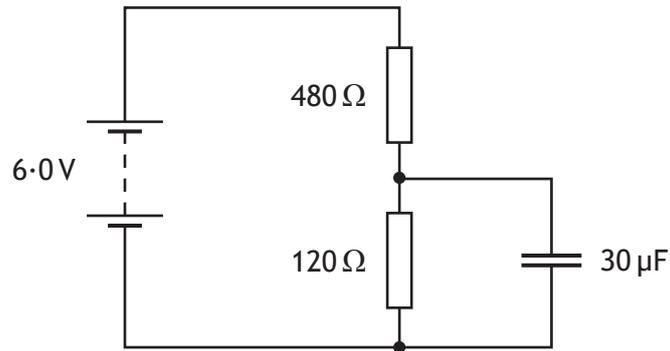
The Y-gain setting on the oscilloscope is 1.0 V/div .

The r.m.s. voltage of the power supply is

- A 2.1 V
 - B 3.0 V
 - C 4.0 V
 - D 4.2 V
 - E 6.0 V .
17. A $20\ \mu\text{F}$ capacitor is connected to a 12 V d.c. supply.
The maximum charge stored on the capacitor is

- A $1.4 \times 10^{-3}\text{ C}$
- B $2.4 \times 10^{-4}\text{ C}$
- C $1.4 \times 10^{-4}\text{ C}$
- D $1.7 \times 10^{-6}\text{ C}$
- E $6.0 \times 10^{-7}\text{ C}$.

18. A circuit containing a capacitor is set up as shown.



The supply has negligible internal resistance.

The maximum energy stored in the capacitor is

- A $5.4 \times 10^{-4} \text{ J}$
- B $3.5 \times 10^{-4} \text{ J}$
- C $1.4 \times 10^{-4} \text{ J}$
- D $3.4 \times 10^{-5} \text{ J}$
- E $2.2 \times 10^{-5} \text{ J}$.

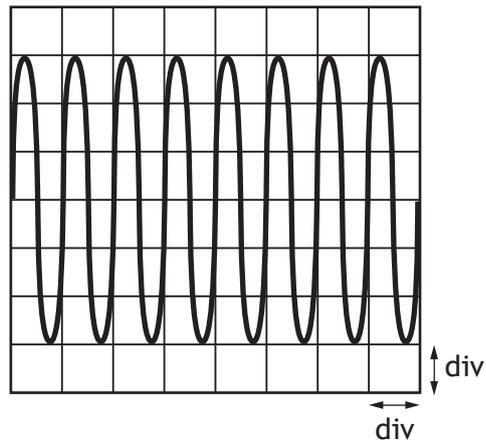
19. A student makes the following statements about conductors, insulators and semiconductors.

- I In conductors, the conduction band is completely filled with electrons.
- II In insulators, the gap between the valence band and the conduction band is large.
- III In semiconductors, increasing the temperature increases the conductivity.

Which of these statements is/are correct?

- A I only
- B II only
- C III only
- D I and II only
- E II and III only

17. The output of a signal generator is connected to the input of an oscilloscope. The trace produced on the screen of the oscilloscope is shown.



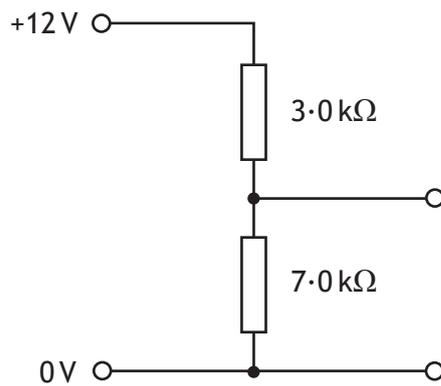
The timebase control of the oscilloscope is set at 2 ms/div.

The Y-gain control of the oscilloscope is set at 4 mV/div.

Which row in the table shows the frequency and peak voltage of the output of the signal generator?

	<i>frequency (Hz)</i>	<i>peak voltage (mV)</i>
A	0.5	12
B	0.5	6
C	250	6
D	500	12
E	500	24

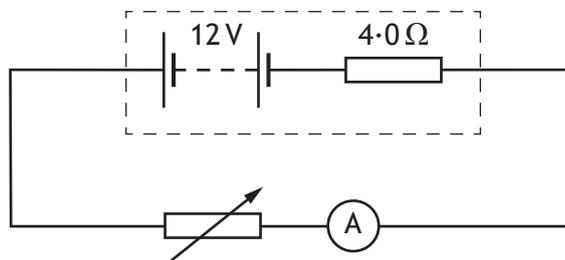
18. A potential divider circuit is set up as shown.



The potential difference across the $7.0\text{ k}\Omega$ resistor is

- A 3.6 V
- B 4.0 V
- C 5.1 V
- D 8.4 V
- E 9.0 V.

19. A circuit is set up as shown.



The resistance of the variable resistor is increased and corresponding readings on the ammeter are recorded.

Resistance (Ω)	2.0	4.0	6.0	8.0
Current (A)	2.0	1.5	1.2	1.0

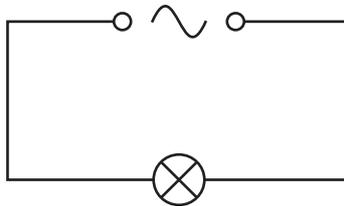
These results show that as the resistance of the variable resistor increases the power dissipated in the variable resistor

- A increases
- B decreases
- C remains constant
- D decreases and then increases
- E increases and then decreases.

20. A $20\ \mu\text{F}$ capacitor is connected to a $12\ \text{V}$ d.c. supply.
The maximum charge stored on the capacitor is

- A $1.4 \times 10^{-3}\ \text{C}$
- B $2.4 \times 10^{-4}\ \text{C}$
- C $1.2 \times 10^{-4}\ \text{C}$
- D $1.7 \times 10^{-6}\ \text{C}$
- E $6.0 \times 10^{-7}\ \text{C}$.

18. A circuit is set up as shown.



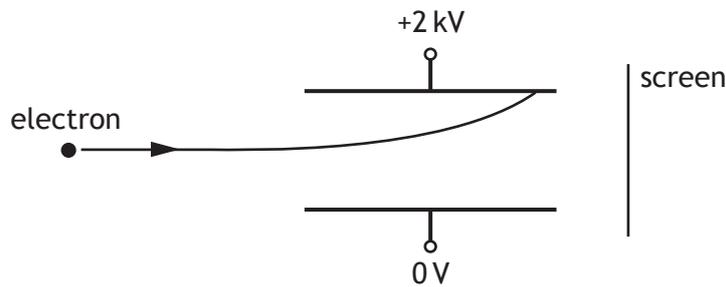
The r.m.s voltage across the lamp is $12\ \text{V}$.

The power produced by the lamp is $24\ \text{W}$.

The peak current in the lamp is

- A $0.71\ \text{A}$
- B $1.4\ \text{A}$
- C $2.0\ \text{A}$
- D $2.8\ \text{A}$
- E $17\ \text{A}$.

11. A potential difference of 2 kV is applied across two metal plates.
An electron passes between the metal plates and follows the path shown.



A student makes the following statements about changes that could be made to allow the electron to pass between the plates and reach the screen.

- I Increasing the initial speed of the electron could allow the electron to reach the screen.
- II Increasing the potential difference across the plates could allow the electron to reach the screen.
- III Reversing the polarity of the plates could allow the electron to reach the screen.

Which of these statements is/are correct?

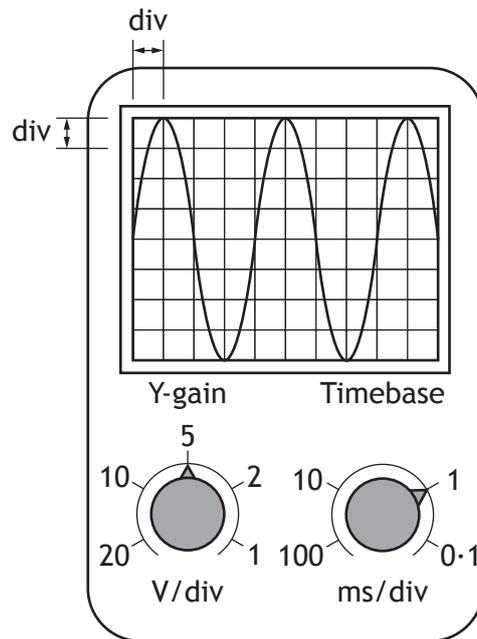
- A I only
 - B II only
 - C III only
 - D I and II only
 - E I and III only
19. A student makes the following statements about energy bands in different materials.

- I In metals the highest occupied energy band is not completely full.
- II In insulators the highest occupied energy band is full.
- III The gap between the valence band and conduction band is smaller in semiconductors than in insulators.

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

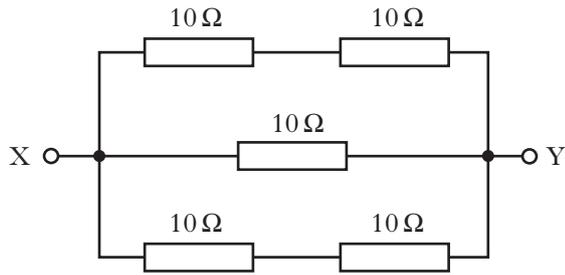
17. The output from a signal generator is connected to the input terminals of an oscilloscope. The trace observed on the oscilloscope screen, the Y-gain setting and the timebase setting are shown.



The frequency of the signal shown is calculated using the

- A timebase setting and the vertical height of the trace
- B timebase setting and the horizontal distance between the peaks of the trace
- C Y-gain setting and the vertical height of the trace
- D Y-gain setting and the horizontal distance between the peaks of the trace
- E Y-gain setting and the timebase setting.

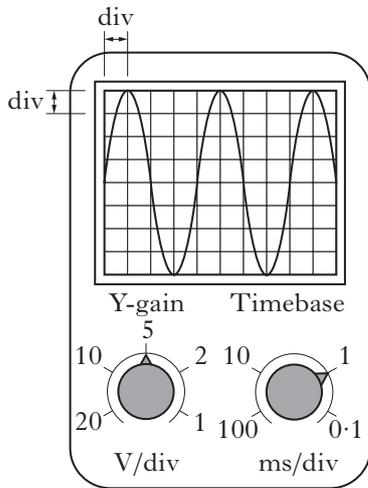
18. The diagram shows part of an electrical circuit.



What is the resistance between X and Y?

- A 0.2 Ω
- B 5 Ω
- C 10 Ω
- D 20 Ω
- E 50 Ω

19. An alternating voltage is displayed on an oscilloscope screen. The Y-gain and the timebase settings are shown.



Which row in the table gives the values for the peak voltage and frequency of the signal?

	Peak voltage/V	Frequency/Hz
A	10	100
B	10	250
C	20	250
D	10	500
E	20	1000

20. The letters **X**, **Y** and **Z** represent missing words in the following passage.

Solids can be categorised as conductors, semiconductors or insulators.

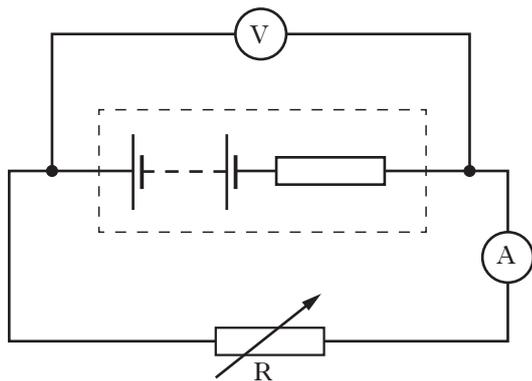
*In . . . **X** . . . the energy gap between the valence band and the conduction band is . . . **Y** . . . , allowing . . . **Z** . . . conduction to take place at room temperature.*

Which row in the table shows the missing words?

	X	Y	Z
A	conductors	large	no
B	semiconductors	small	no
C	conductors	large	some
D	semiconductors	small	some
E	insulators	small	no

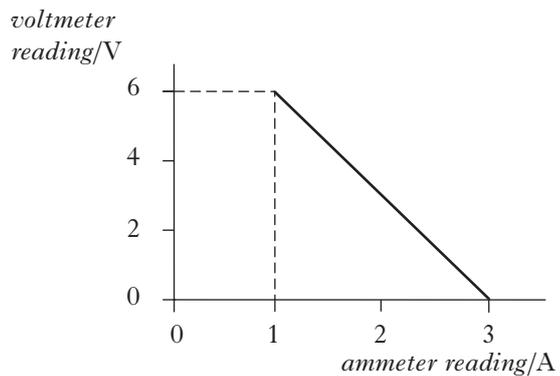
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17. A circuit is set up as shown.



The variable resistor R is adjusted and a series of readings taken from the voltmeter and ammeter.

The graph shows how the voltmeter reading varies with the ammeter reading.



Which row in the table shows the values for the e.m.f. and internal resistance of the battery in the circuit?

	<i>e.m.f./V</i>	<i>internal resistance/Ω</i>
A	6	2
B	6	3
C	9	2
D	9	3
E	9	6

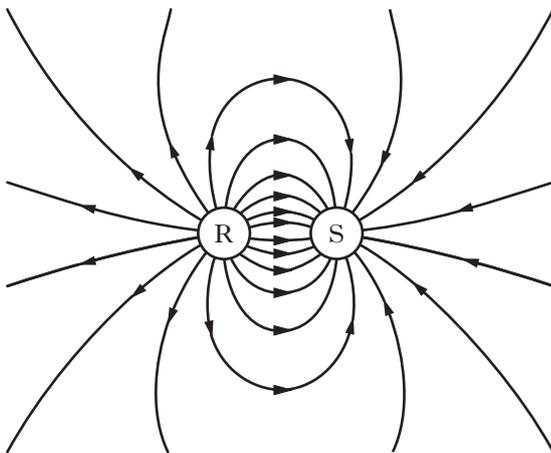
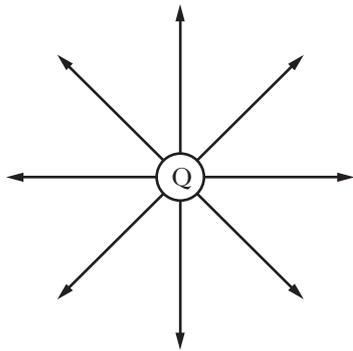
11. A student writes the following statements about electric fields.

- I There is a force on a charge in an electric field.
- II When an electric field is applied to a conductor, the free electric charges in the conductor move.
- III Work is done when a charge is moved in an electric field.

Which of the 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

8. The electric field patterns around charged particles Q, R and S are shown.

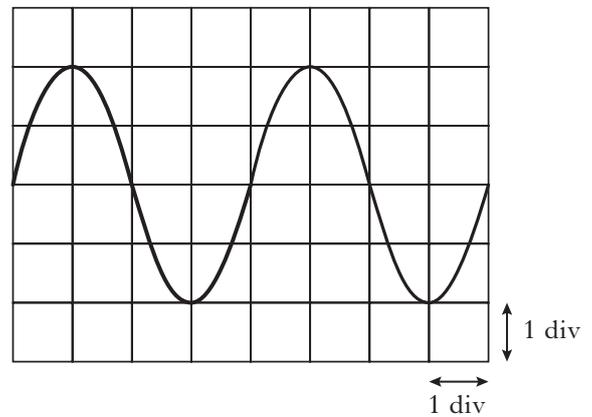


Which row in the table shows the charges on particles Q, R and S?

	<i>Charge on Q</i>	<i>Charge on R</i>	<i>Charge on S</i>
A	positive	positive	negative
B	negative	negative	positive
C	negative	positive	negative
D	negative	negative	negative
E	positive	positive	positive

15. An oscilloscope is connected to the output terminals of a signal generator.

The trace displayed on the screen is shown below.



The timebase of the oscilloscope is set at 30 ms/div.

The frequency of the output signal from the signal generator is

- A 4.2×10^{-3} Hz
- B 8.3×10^{-3} Hz
- C 0.28 Hz
- D 4.2 Hz
- E 8.3 Hz.

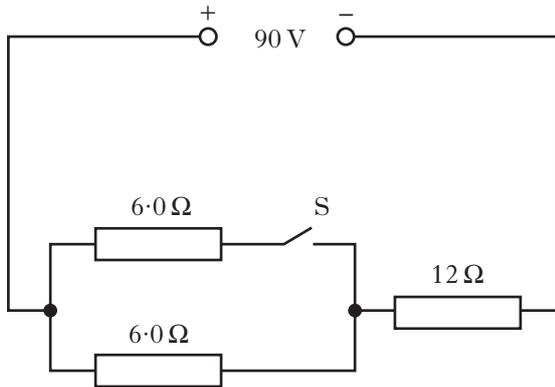
19. A student makes the following statements about p-n junction devices.

- I In solar cells, a potential difference is produced when photons are incident on the junction.
- II The photovoltaic effect occurs in solar cells.
- III In LEDs, photons are emitted from the junction when a current is passed through it.

Which of these statements is/are correct?

- A I only
- B III only
- C I and II only
- D I and III only
- E I, II and III

17. A circuit is set up as shown.



The internal resistance of the supply is negligible.

Which row in the table shows the potential difference (p.d.) across the 12 Ω resistor when switch S is open and when S is closed?

	<i>p.d. across 12 Ω resistor when S is open/V</i>	<i>p.d. across 12 Ω resistor when S is closed/V</i>
A	30	18
B	45	45
C	60	45
D	60	72
E	72	60

18. The letters **X**, **Y** and **Z** represent missing words from the following passage.

Solids can be divided into 3 broad categories: conductors, insulators and semiconductors.

*In ...**X**... the conduction band is not completely full and this allows electrons to move easily.*

*In ...**Y**... the valence band is full.*

*In ...**Z**... electrons can move from the valence to the conduction band at room temperature.*

Which row in the table shows the missing words?

	X	Y	Z
A	conductors	insulators	semiconductors
B	semiconductors	insulators	conductors
C	insulators	semiconductors	conductors
D	conductors	semiconductors	insulators
E	insulators	conductors	semiconductors