AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



MARK SCHEME

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 3)

SCORE	PERCENTAGE
/174	%

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Q1.

(a) in range 6 < I ≥ 13 A

for 1 mark
(no unit no mark)

1

(b) 4

gains 2 marks

(else working

gains 1 mark

(resistance of circuit correctly worked (2Ω))

2

(c) 72 (I^2 R) ecf

gains 2 marks

else working

gains 1 mark

an answer of 36W (ie for one lamp) – (1)

2

(d) 1000 or 16.7 min (ecf from (c))

gains 2 marks

else working

gains 1 mark
(formula with incorrect substitution – no mark (12V)

2

[7]

Q2.

(a) Current = 0.4A (1)
R = V/I or 240/0.4 (1)
R = 600 ohm (1)

3

(b) Doubles

gets 2 marks

OR gets bigger

gets 1 mark

2

(c) P = V.I or 240 × 0.4
P = 96W

for 1 mark each

2

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(d) 1 = 0.2A
P = 48W

for 1 mark each

BUT may get equation mark here if not in (c)

2

(e) P = V.I.t (1)
P = 240 × 0.2 × 6 × 3600
OR P = 48 × 6 × 3600

gets 1 mark

P = 1036800 W

gets 1 mark

3

[12]

Q3.

(a) to switch on/off
independently OWTTE

for 1 mark each

2

(b) 9

for 1 mark

1

(c) B and E

for 1 mark

1

(d) 1

Two/least number of LED used

for 1 mark each

2

[6]

Q4.

(a) (i) the lamp will be on/will give out light

1

(ii) the lamp will be off/will not give out any light

1

(b) (very) large current flows
or damage the battery/overheat the battery
or short circuit
or wire get hot

1

(c) switch connected in series with lamp and battery

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1

[4]

Q5.

(a) ... ammeter

for 1 mark

1

(b) 5 right

gains 4 marks

4 right

gains 3 marks

3 right

gains 2 marks

2 right

gains 1 mark

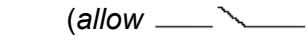
4

[5]

Q6.

(a) 4 symbols correct accept

(accept ◯ for bulb; lose 1 mark if line through symbols, lose 1 mark if circuit incorrect, switch may be open or closed)

(*allow*  **or** )

gains 1 mark

4

but

all correct

gains 2 marks

ammeter in series with lamp

for one mark

voltmeter in parallel with lamp / lamp and switch / lamp, switch and ammeter

for one mark

(b) (i) 5 points correctly plotted

allow (0, 0) correct if graph goes through the origin even if no × or O

gains 1 mark

but

6 points correctly plotted

gains 2 marks

smooth curve through points – not straight line / curve + straight line

for one mark

3

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(ii) 2 (A)

allow ± 0.05 (½ square) from candidates' graph
for one mark

1

(iii) R = V / I **or** R = 10 / 2
gains 1 mark

but
R = 5 (Ohms) ecf
gains 2 marks

2

(c) (i) resistance increases
for one mark

(ii) temperature (of filament) has increased / filament gets hot
for one mark

2

[12]

Q7.

(a) (i) variable resistor
accept rheostat

1

(ii) potential difference = current × resistance
*accept V = IR **or** any correct combinations*

1

(b) (i) as the potential difference increases, the current increases
accept it increases

1

at low values of the potential difference the current is (directly) proportional
accept at low values of the potential difference (the filament) obeys Ohm's law

1

or
at higher values of potential difference the current is not (directly) proportional
or
accept at higher values of the potential difference (the filament) does not obey Ohm's law
accept it increases but not proportionally for 2 marks

(ii) the resistance (of the filament) increases

1

the temperature (of the filament) increases

1

[6]

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Q8.

(a) (i) resistor

1

(ii) voltage / potential difference / volts / v

1

(iii) current / amps / A

1

(b) potential difference = current × resistance

no mark if more than one box ticked

1

[4]

Q9.

(a) variable resistor

accept rheostat

1

(b) voltmeter

1

(c) straight line correct between 0.2 and 0.8

if line incorrect, or no line, and correct plots 0.2 to 0.8 award 1 mark

2

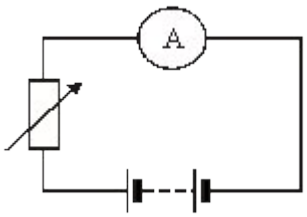
(d) diode / rectifier

1

[5]

Q10.

(a)



3

one mark for each symbol
allow more than 2 cells joined

max. 2 marks if symbols incorrectly allow rheostat arrow in either direction

(b) current will decrease

1

since resistance greater

1

[5]

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Q11.

(a) ammeter anywhere in series in the circuit

accept just letter A or box with A

voltmeter across **or** in parallel with the fixed resistor only

accept just letter V or box with V

2

(b) (i) four correct plots

deduct one for any incorrect plot

a straight line through the points

no requirement to extrapolate through origin

*do not credit bar charts unless correct line drawn **or** correct points*

2

(ii) 0.25

ecf rule applies if graph is wrongly plotted

1

[5]

Q12.

(a) (i) power ÷ voltage = current **or**
2800 ÷ 240 = 11.6 – 11.7 **or** 12

2 marks for correct answer 1 mark for 2.8 ÷ 240

2

(ii) resistance = voltage ÷ current

240 ÷ 11.7

(efc here)

1

20.5 **or** 20.57 **or** 20.6 **or** 21

2 marks for correct answer

1

ohms **or** Ω

do not credit R

1

(b) 850 ÷ 1500 × 100

marks only available for division of power

1

= 56.7

2 marks for correct answer
for 1 mark accept 5670

1

[7]

Q13.

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(a) 0.9

1

1.1

accept the value of A_4 + 0.2

1

(b) V = I R **or** 12 = 0.6 R **or** $\frac{12}{0.6} = ?$

accept V = A R
V = I × ohm's sign
do not credit Ohm's law triangle

2

R = 20

correct numerical answer earns both marks

ohms

1

(c) A_3 = 0.3

A_4 = 0.3

accept the same numeric value as A_3

A_5 = 0.5

accept the value of A_4 + 0.2

3

[8]

Q14.

(a) (i) the same as

1

(ii) less than

1

(iii) the same as

1

(iv) more than

1

(b) 3

accept D

because there is more **or** twice the current in this part of the circuit **or** the resistance is less

*accept only one lamp to go through, (not two) **or** on its own not sharing the voltage **or** energy with another*

*do not credit one lamp to go through **or** sharing current*

2

[6]

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Q15.

(a) series circuit

all four components must be included

if a battery included the neatness mark may still be awarded

1

circuit fully functional **or** properly connected

this is the neatness mark

do not credit a parallel circuit with one switch controlling both components

1

(b) case **or** outer parts are made of plastic **or** insulator **or** non-metallic

1

there is no electrical pathway between inner and outer insulation

accept no connection between inner and outer part

do not credit two layers of insulation

1

(c) (i) [A] power = voltage × current

accept $P = V\ I$ ***or***

$W = V \times A$

or *any transformation*

1

[B] 1600 ÷ 230 =current

1

6.96 **or** 7

accept with no working for two marks

accept 6.95

in [A] award a mark for a triangle if calculation correctly performed

1

(ii) [A] voltage = current × resistance

accept $V = I\ R$ ***or*** *any transformation*

1

[B] 230 ÷ 7 = overall R = 33

accept 230 ÷ 6.96 = overall R = 33

1

resistance of motor = 33 – 20 = 13

accept with no working for two marks

do not credit negative answer

accept consequential errors from c(i)

in [A] award a mark for a triangle if calculation correctly performed

1

[10]

Q16.

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(a) (i) P = V × 1

or equivalent

credit a triangle if part (ii) correctly uses the relationship

*credit power = volts × amps **or** watts V × A*

do not accept C for current

1

(ii) (P = 230 × 10 =) 2300

credit 2.3

1

W **or** J/s

kW

1

(b) (i) 15 A

*credit 13 A **or** amps*

1

(ii) any **three** from

earth

any short (to the metal tank) causes fuse to blow

fuse is in the live wire

to prevent damage to the heater

credit to stop the current

3

(c) (i) V = I × R

or equivalent

credit a triangle if part (ii) correctly uses the relationship

1

(ii) (230 = 10 × R =) 23

ohms **or** Ω

2

[10]

Q17.

(a) (i) 0.2

1

(ii) 0.2

1

(b) (i) a series circuit must contain two cells the correct way round and an ammeter

*accept the components in any order in the series circuit but there must be no obvious gaps in the wires at corners **or** joins*

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1

the symbol for a variable resistor a rectangle with a diagonal arrow drawn through it

accept a diagram for a 'slide resistor'

1

(ii) decrease

1

[5]

Q18.

(a) A = battery (of cells)/cells/cell
B = thermistor/temperature dependent resistor
C = transistor
D = LED/light emitting diode
E, F, G = resistors

each for 1 mark

5

(b) *ideas that* (resistance) falls from 3000 to 200 units – ohms/Ω – referred to at least once

each for 1 mark

(*credit quickly at first then more slowly with 2 marks*) (*max 4 for part (b)*)

4

(c) any figure in the range 22 – 26 (inclusive)

gains 1 mark

but 24

gains 2 marks

2

[11]

Q19.

(a) current rises/starts lower/starts from zero

for 1 mark

ideas that: *
smaller/only 0.45 (A) change in current
quicker/only 2 (ms) for current to settle
slightly lower/0.45 (A) final current
maximum only 0.45 (A) rather than 1.5 (A)
(*must **compare** e.g. "only..." or state figure from first graph)

any 2 for 1 further mark each

3

(b) resistance of filament rises as temperature rises/higher at operating temperature
resistance of X falls as temperature rises/low(er) at operating temperature
total resistance stays roughly the same as temperature rises
so current stays roughly the same as temperature rises
(must be related to previous point)

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resistance of X falls faster at first than resistance of filament rises
so current rises (*must be related to previous point*)
operating resistance slightly increased
so operating current slightly reduced
(*must be related to previous point*)
resistance of X high at start
so current zero/low

each gains 1 mark
(must be related to previous point)
(to a maximum of 4)

4

[7]

Q20.

(a)
- diode
- voltmeter
- ammeter

for 1 mark each

3

(b) *idea that*

- current increases or goes up (with voltage)

  gains 1 mark

- 'It' refers to current
  but current increases steadily (with voltage)

  gains 2 marks

- (*allow* in proportion) – but not simply a description of the shape of the graph

  gains 1 mark

- no current at first
  but no current until voltage is more than 0.3 (volts)

  gains 2 marks

4

[7]

Q21.

(a) motor

1

(b) fuse or circuit breaker

1

(c) voltmeter

each for 1 mark

1

[3]

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Q22.

(a) *idea that*

it/current increases (with voltage)
gains 1 mark

but
current increases steadily (with voltage)
(allow in proportion)
gains 2 marks

4

no current at first
gains 1 mark

but
no current until voltage is more than 0.3 (volts)
gains 2 marks

(b) (i) reverse component X/power supply/change battery round
for 1 mark

(ii) *idea that*
X doesn't conduct in opposite/let current through/no current (in opposite direction)
(credit X is a diode*)*
for 1 mark

2

[6]

Q23.

(a) (i) diode
[Do not accept 'rectifier' or LED]

(ii) lamp / bulb / light
each for 1 mark

2

(b) • P = voltage / potential difference / p.d. / volts / V
[Allow 'Voltmeter]

• Q = current / amperes / amps / A
[Allow 'ammeter]
each for 1 mark

2

[4]

Q24.

(a) cell and bulb / light correctly labelled
for 1 mark each

2

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(b) ordinary cell has higher voltage (normally / at start)

for 1 mark

or

ordinary cell 1.3V nicad 1.2V (normally / at start)

voltage of ordinary cell falls more slowly (*accept* lasts longer)

gains 1 mark

but

as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds e.g. falls to zero in 70 seconds compared to 16 seconds – from time zero

or

nicad falls to zero 10 times as fast

gains 2 marks

3

(c) (i) answer in range 32-34 (seconds) (inclusive)

gains 1 mark

but

answer in range 22-24 (seconds) (inclusive)

gains 2 marks

(ii) 12 (seconds)

gains 1 mark

but

2 (seconds)

units not required in (c)

gains 2 marks

4

[9]

Q25.

(a) ordinary cell has higher voltage (normally / at start)

or

ordinary cell 1.3V nicad 1.2V (normally / at start)

for 1 mark

voltage of ordinary cell falls more slowly

gains 1 mark

(*accept* ordinary cell lasts longer)

but

as above with relevant quantification e.g. falls to zero in 60 seconds compared to 6 seconds

or

nicad falls to zero 10 times as fast

gains 2 marks

3

(b) (i) answer in range 32-34 (seconds) (inclusive)

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gains 1 mark

but
answer in range 22-24 (seconds) (inclusive)
gains 2 marks

(ii) 12 (seconds)
gains 1 mark

but
2 (seconds)
gains 2 marks

4

(c) resistance of the lamp / filament changes / increases
gains 1 mark

but
resistance of the lamp / filament decreases
gains 2 marks

because the temperature of the filament falls / filament cools
for 1 mark

3

[10]

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