Electricity Memo – Form 5

1.1.1 slip rings√ – to make an electrical √connection to the brushes or external circuit.
(2)

1.1.2 The induced current increases√ with the rate of change √of magnetic √flux linkage.
(3)

1.1.3 clockwise (1)

1.1.4 The amount of energy lost√ due to heating effect√ is less at low current (2)

1.2.1 (5)

- ✓ cos graph (if they do sine graph but have period correct 3/5)
- ✓ ✓ axes labelled
- ✓ ✓ two x- intercepts marked

1.2.2 P = W/t

6000 = W/(20x 60) √(conv. mins to secs)

W = 6000 x 1200√

= 7200000 J (7200 kJ) √ (3)

1.3 Wind power is a renewable resource (environmental ' +')

It also produces no greenhouse gases (enviro '+')

It is expensive to build (economic ' – ')

No fuel required (wind free) (economic '+')

Only work when there is wind ('-') (4)

2.1 D

2.2 Downwards

2.3
- increase strength of mag field of magnets
- increase current
- add more coils of wire
- keep field ⊥ to coil (curved magnets)

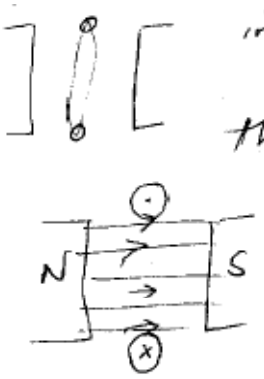
any 3 (3)

2.4
- Coil is mounted so that it is free to rotate.
- The two magnetic fields combine — reinforcing in some regions, cancelling in others
- This caused a turning force
- After ½ revolution the current direction in the coil is reversed — This is done with the aid of the split ring commutator.
- This allows for the coil to rotate for 180°

(4) — well ordered ✓ consise ✓ facts.

2.5 Upwards

2.6



in the vertical position

the mag field are in same direct
and coil is outside field

(2)

(2)

2.7 Electrical energy → mechanical energy

2.8

at the split ring with the carbon brushes
There is friction which could result in
heat and sound energy (3)

3.1 B

3.2 AC = alternating – changes direction all the time ✓✓
DC = direct current – charges move the same direction all the time ✓✓ (2)

3.3 Add a commutator

3.4 It will turn a paddle wheel – (fast flowing water) connected to the armature – coil so that it rotates inside a magnetic field.

3.6 Clockwise

4.1 A

4.2 A semiconductor doped with excess electrons

4.3 B1

4.4 a) neg voltage = reverse bias, diod does not conduct ✓ (2)
b) 20 mA ✓ (1)
c) 

$R = \frac{V}{I}$ ✓
$= \frac{(6-0,7)}{0,02}$ ✓ = 265 Ω ✓ (5)

4.5 ; LED – made from either gallium arsenide or gallium phosphide, energy produced when e⁻ and holes combine given off in form of light
low V ⇒ not based on heating effect
⇒ depends on chemical used in doping

5.1 Electric energy is converted to (rotational) mechanical energy. ✓✓ (2)

5.2 A DC motor reverses current direction whenever the coil is in the vertical position to ensure continuous rotation. ✓✓

An AC motor, with alternating current as input, works without commutators since the current alternates. ✓✓ (4)

5.3 (a) Clockwise ✓ (1)

(b) Fleming's left hand motor rule ✓ (1)

(c) Its own momentum ✓✓ (2) **[10]**

QUESTION 6

6.1 In an ordinary light bulb, the filament becomes so hot that it glows. Only a small percentage of the energy is converted into visible light. More than 90% of the energy is transformed into heat energy. ✓

In a fluorescent light bulb, electrons strike the gas in the tube and cause them to be excited. ✓

When the excited atoms jump back to their normal levels, they emit UV photons that strike the fluorescent coating on the inside of the tube, causing it to fluoresce. ✓

More than 80% of energy is converted to visible light. ✓ (4)

6.2 Geyser blankets insulate the geyser, significantly reducing the loss of heat energy. ✓✓ (2)

6.3 Boil water in a kettle and then store the boiled water in a flask. ✓

Avoid excessive use of electrical appliances that have heaters, e.g. tumble dryers, dishwashers, washing machines, etc. ✓ (2)

6.4 **Pros:** consumers to convert to gas stoves; energy savings; efficient use of diminishing natural resources. ✓✓

Cons: price of gas increased; lower-income earners spend even more money; no infrastructure to allow gas to be piped to homes. ✓✓ (4) **[12]**

QUESTION 7

7.1 Current has a heating effect. Water removes excess heat caused by current. ✓✓ (2)

7.2 Resistance decreases, allowing more efficient transmission of power. ✓✓ (2)

7.3 It is wasted; dissipated in the earth, which is environmentally unsound. ✓✓ (2)

7.4 Use AC current. The voltage is stepped up and the current is stepped down using a transformer. ✓✓ (2)

7.5 Low installation costs; cheaper to run since air can act as the coolant. ✓✓ (2)

7.6 Pylons take up lots of space; they are potentially dangerous because the wind can blow them against buildings. ✓✓ (2)

7.7 Variation in the sun's radiation results in variable power supply – not conducive for required steady supply of electricity. Increasing the number of solar panels is not always economic. ✓✓

Insufficient land where wind blows constantly to generate electricity in significant quantities. Also less cost-effective at this stage. ✓✓ (4) **[16]**

8.1 $\frac{1}{R} = \frac{1}{15} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15} + \frac{1}{15}$ 3 (method)
3 substituting
$= \frac{5}{15}$ 3
$R = \underline{3{,}0\ \Omega}$ 3accuracy (- 1 no units) (4)

8.2 $P = \frac{V^2}{R}$ 3 method (may calculate I = 4 A, the P=VI = 48W)
$= \frac{(12)^2}{3}$ 3substitution
3correct value of R (c.o.e)
$= \underline{48\ W(J.s^{-1})}$ 3accuracy (-1 no units) (4)

8.3 Lesser;3 the effective resistance will increase 33therefore power will decrease also as can be seen by using the equation $P = V^2/R$ 3 (4)

8.4 New resistance = 15/3 = 5 Ω 3
New power = 144/5 = 28,8 W3
$\frac{\text{New power}}{\text{Power}} = 0{,}6$ 3
Therefore power decreases by a factor of 0,4 (or 2/5)3 (4)

8.5 E = I(R + r) 3(method)
123 = I (3 + 2,5) 3(substitutions)
I = 2,18 A 3(accuracy; -1 no units) (4)

[20]

9.1	The power per unit current √√supplied by the cell is 1,10 watts per ampere √ OR The total amount of energy supplied by the cell per coulomb of charge passing through it√√ is 1,10 joules per coulomb√
9.2	Emf = I (R + r) √ 1,103 = 0,0025 (3,0 + r)√ r = 1,093 Ω (1,0925)√
9.3	Effective resistance√ of two light bulbs = 3,0/2 3= 1,5 Ω√

	OR I/R = 1/3 + 1/3√ = 2/33 therefore R = 3/2 = 1,5 Ω√ Emf = I (R + r) 1,10 √= I (1,5 + 1,0925)√ I = 0.424 A√
9.4.1	1,10 V
9.4.2	Effective resistance = 1,0925/4√ = 0,273 Ω√ OR 1/R = 1/1.0925 + 1/10925 + 1/1.0925 + 1/1.0925√ = 4/1.0925 therefore R = 1.0925/4 = 0,273 Ω√
9.5	The reading will increase√ The internal resistance of the cell will decrease√because there is a greater surface area of zinc exposed and able to take part in reactions√

10.1	Potential difference: the amount of energy transferred per unit positive3 test3 charge3 placed in an electric field.
10.2	Using R = V/I3 Substituting V = 4,09 V3 Substituting I = 0,082 A3 $R = 50\ \Omega 3$
10.3	Two resistors in series = 2 R3 Parallel combination of R and 2R Using 1/R etc OR product/sum 3 Correct substitutions 33 Each resistor has resistance of 75 Ω 3
10.4	Emf = 3 $\times$ 1,5 V3=4,5 V3
10.5	Emf = IR + Ir3 4,53= 4,09 3 + (0.82)3r r = 5 Ω3 Each cell has average value of 5/3 = 1,67 Ω3