Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE 2010

MARKING SCHEME

PHYSICS & CHEMISTRY

ORDINARY LEVEL

General Guidelines

In considering this marking scheme the following points should be noted.

1. In many instances only key words are given, words that must appear in the correct context in the candidate's answer in order to merit the assigned marks.

2. Marks shown in brackets represent marks awarded for partial answers as indicated in the scheme.

3. Words, expressions or statements separated by a solidus, /, are alternatives which are equally acceptable.

4. Answers that are separated by a double solidus, //, are answers which are mutually exclusive. A partial answer from one side of the // may not be taken in conjunction with a partial answer from the other side.

5. The descriptions, methods and definitions in the scheme are **not** exhaustive and alternative valid answers are acceptable. Marks for a description may be obtained form a relevant diagram, depending on the context.

6. The context and the manner in which the question is asked and the number of marks assigned to the answer in the examination paper determines the detail required in any question. Therefore, in any instance, it may vary from year to year.

7. Where indicated, 1 mark is deducted for incorrect/ no units.

8. Each time an arithmetical slip occurs in a calculation, one mark is deducted.

Question 1   **Answer any eleven parts**

(*a*) **The mass of a suitcase is 5 kg. What is the weight of the suitcase when it is placed on the hook of a newton balance as shown in Figure 1?**
$W = mg$ / $W = 5 \times 9.8$ …5
49 (N)   …1

(*b*) **What is the unit of *work*?**
joule / Nm / J / newton metre   ...6

(*c*) **Water freezes at 0 ºC. What is this temperature on the Kelvin scale?**
273 (K)   …6

(*d*) **Give one example of a thermometric property.**
length of mercury (alcohol) column / pressure / volume / emf / resistance, etc.
                                                                any one …6
[definition …3]

(*e*) **Figure 2 shows a ray of light passing through a glass prism. Name the phenomenon that occurs at X.**
total internal   …1
reflection   …5

(*f*) **Give one use of a concave mirror.**
to produce magnified image/to produce upright image / make-up mirror / shaving mirror / dentist's mirror / reflecting telescopes / reflector for lights /headlamps / floodlights / torch / spotlights / microscope   any one…6
[use of convex mirror …3]

(*g*) Which one of the following types of radiation has the highest frequency?
      radio waves   blue light   ultraviolet light   red light
ultraviolet light   …6
[radio waves   ….3]

(*h*) **During the photoelectric effect, what is released from the surface of a metal?**
electrons   …6

(*i*) **In the equation for *Coulomb's law*, $F = \dfrac{1}{4\pi\varepsilon}\dfrac{q_1 q_2}{d^2}$, what does *d* represent?**
distance (between centres of point charges)   …6

(*j*) **Figure 3 shows two 4 μF capacitors connected in parallel.**
What is the effective capacitance of the combined capacitors?
8 (μF)   ...6
2 (μF) / 0.5 (μF) …3]

(*k*) **A television, rated at 200 W, is left on continuously for four hours.**
Calculate the number of units (kW h) used.
$200 \times 4 = 800$ …5
$800 \div 1000 = 0.8$ …1

(*l*) **What is the advantage of transmitting electricity at a high voltage?**
energy losses reduced */* more efficient / less waste, etc.   …6

(*m*) **What would you use to detect the presence of a magnetic field?**
compass / iron filings / magnet (suspended nearby to swing freely)
 / deflection of charged particles   any one...6

(*n*) **A sample of a radioactive isotope has a half-life of 3 days.**
What fraction of the sample will remain after 9 days?
3 half lives   …5
⅛   …1

(*o*) **Give one difference between *nuclear fission* and *nuclear fusion*.**
fission involves splitting (nuclei) / fusion involves joining (nuclei) / fission produces isotopes with
long half-lives / fusion produces isotopes with short half lives / fission fuel toxic /fission fuel scarce
/ fusion fuel plentiful / fission controlled / fusion uncontrolled / fusion in sun / fission in nuclear
power stations, etc   any one…6

Question 2

Define (i) *velocity* <u>**5, 1**</u>
rate of change // change of displacement ...5
of displacement // wrt time ...1
or
s ÷ *t* // *speed* ...5
explain *s* and *t* // in a given direction ...1

(ii) acceleration <u>**2×3**</u>
rate of change // change of velocity ...3
of velocity // wrt time ...3
or
$(v - u) \div t$ ...5
explain *u, v* and *t* ...1

State the *principle of conservation of momentum*. <u>**6, 2×3**</u>
total momentum before / $m_1u_1 + m_2u_2$ ...6
equals / = ...3
momentum after / $m_1v_1 + m_2v_2$ ...3
or
total ...3
momentum ...3
remains constant ...6

Bumper cars are a popular attraction in amusement parks. A bumper car starts from rest on a smooth horizontal surface and reaches a velocity of 2 m s⁻¹ in 4 seconds.
Calculate: (iii) the acceleration of the bumper car <u>**2×3**</u>
$v = u + at / (v - u) \div t / (2 - 0) \div 4$ ...3
0.5 (m s⁻²) ...3

(iv) the distance travelled by the bumper car in the first 4 seconds. <u>**2×3**</u>
$s = ut + \frac{1}{2}at^2 // v^2 = u^2 + 2as // s = \frac{1}{2}(u + v)t$ ...3
$s = (0 \times 4) + \frac{1}{2}(0.5 \times 16) = 4$ (m) //$(4 - 0) \div 2 \times 0.5 = 4$ (m) // $\frac{1}{2}(0 + 2) \times 4 = 4$ m ...3
[$s = vt = 8$ m ...3]

Figure 4 shows bumper car A of total mass 250 kg moving on a smooth horizontal surface at a velocity of 2 m s⁻¹. Bumper car A collides into a stationary bumper car B of total mass 200 kg.
After the collision bumper car B moves off with a velocity of 1.5 m s⁻¹.
Calculate: (v) the momentum of bumper car A *before* **the collision** <u>**2×3**</u>
m_1u_1 ...3
$= 250 \times 2 = 500$ (kg m s⁻¹) ...3

(vi) the momentum of bumper car A *after* **the collision** <u>**3×3**</u>
$(200 \times 1.5) = 300$ ...3
$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$ / 500 (+ 0) $= m_1v_1 + 300$ ...3

$(m_2v_2 =) 200$ (kg m s⁻¹) ...3

(vii) the velocity of bumper car A *after* **the collision.** <u>**2×3**</u>
$200 \div 250$ ...3
$= 0.8$ (m s⁻¹) ...3

What is meant by *kinetic energy*?   <u>2×3</u>

energy due to // work //example   …3

motion // done //   …3

or

$\frac{1}{2}mv^2$ …5

explain *m,* and *v*   …1

Explain why the kinetic energy of bumper car B changes during the collision.   <u>3</u>

energy transferred to B from A/B moves from rest /

B's velocity or speed increases in the collision   **…**3

Question 3

<u>Refraction</u> occurs when light travels from one <u>medium</u> to another. **3×3**
Explain each of the underlined terms.
bending (of light)/change of direction (of light) …6
material/substance/example …3

State one of the *laws of refraction of light*. **3×3**
normal, // sine of angle of incidence/ sin*i* //sin*i* …3
incident ray, refracted ray //proportional to / ∝ //divided by sin*r* …3
in same plane // sine of angle of refraction / sin*r* // is constant …3

Figure 5 shows a ray of light incident at 80º approaching a beaker containing cooking oil.
If the angle of refraction is 42º, calculate the refractive index of the cooking oil. **3×3**
(sin*i*) = 0.9848 (0.99 – 0.98) …3
(sin*r*) = 0.6691 (0.669 – 0.670) …3
(refractive index cooking oil =) 1.47 (1.46 – 1.5) …3

Lenses make use of the refraction of light. Name two devices that use lenses. **2×3**
(reading) glasses / contact lenses / magnifying glass / telescope / microscope / endoscope / binoculars
/camera / spectrometer / eyeglass / loupe / periscope (eyepiece), etc any two …2×3

Describe an experiment to measure the focal length of a converging (convex) lens. **5×3**
Apparatus: converging lens, object, screen or plane mirror and/or locating pin …3
correct arrangement of …3

Method: focus image / move screen
correct measurements of *u* and *v*
calculate *f* / correct formula …3×3

Give one way to improve the accuracy of your result. **3**
find approximate answer by focusing image of distant object on a screen / avoid parallax errors when
reading distances / mirror perpendicular to page / mark back of mirror / narrow beam of light / repeat,
etc. any one …3

Figure 6 shows an object O placed 10 cm from a converging lens of focal length 5 cm.
Copy and complete the diagram to show the formation of the image by the lens. **3×3**
one correct ray to the lens …3
correct refraction …3
2nd ray correct …3

Give two properties of the image observed. **2×3**
inverted, real, same size as object, 10 cm from lens, other side of lens any two …2×3

Question 4

(*a*)
State *Boyle's law*.   **3×3**
volume of (a fixed mass of) gas   ...3
is inversely proportional   ...3
to its pressure at constant temperature   ...3
[omit *at constant temperature* (-1)]

Describe an experiment to verify Boyle's law.   **5×3**
Apparatus: pressure guage, sealed mass of gas, pump / plunger // J tube, mercury,
                        sealed mass of gas   any two listed or labelled on diagram ...3
                        correct arrangement   ...3

Method: measure volume
                        measure pressure
                        vary pressure
                        pV constant
                        any valid precaution   any three...3×3

In Figure 7, a tyre pump contains 180 cm^3 of air at a pressure of 100 kPa. The outlet of the pump is blocked. The handle on the pump is pushed down until the volume of air is reduced to 30 cm^3. Calculate the new pressure of the air inside the pump.   **3×3**
$p_1V_1 = p_2V_2$ ...3
$100 \times 180 = p_2 \times 30$ ...3
600 (kPa)   ...3

(*b*)
The *kinetic theory* is used to explain the behaviour of gases.
Give two assumptions of the kinetic theory of gases.   **9, 3**
elastic collisions / rapid motion / random motion / negligible volume / straight
line motion / negligible duration of collisions / large number of molecules/   1st correct ..9
                                                                                                      2nd correct ...3

Figure 8 represents an <u>ideal gas</u> in a sealed balloon.
What is meant by the underlined term?   **5, 1**
obeys gas laws / obeys Boyle's law / obeys kinetic theory
at all temperatures and pressures
                                                                                                      1st correct ..5
                                                                                                      2nd correct ...1

(i)   How does the velocity of the gas particles change as the balloon is warmed?   **6**
increases / (gas particles) speed up   ...6

(ii)   What is the effect of the gas particles on the walls of the balloon as the balloon is warmed?   **6**
more frequent collisions, balloon walls stretched or expanded   ...6

(iii) Explain why the pressure of the gas increases as the volume of the balloon is reduced.
                                                                                                      3

more frequent collisions / Boyle's law applies   ...3

Question 5

Figure 9 shows a positive and a negative charge at a fixed distance apart.
Copy the diagram and show the electric field between the two charges.   **6, 3**
diagram showing field lines   …6
arrows showing correct direction from positive to negative   …3

'A current is a flow of electrical charges.' Give two effects of an electric current.   **9, 3**
heating/lighting, magnetic, chemical
                                                                  1st correct ..9
                                                                  2nd correct …3

Describe how to demonstrate one of these effects.   **4×3**
electrical supply / battery / main electricity   …3
heating coil or element // compass or iron filings // electrolyte   …3
correct arrangement   …3
temperature rise // deflection or pattern // chemical change   …3
or
valid appliance that demonstrates effect mentioned e.g. kettle, electromagnet, voltameter   …9
operation described   …3

Figure 10 shows a wind-up torch containing a dynamo which is based on the principle of
electromagnetic induction.
State one of the laws of electromagnetic induction.   **6, 3**
voltage / current / emf
proportional to change in magnetic flux // opposes change that caused it
                                                                  1st correct …6
                                                                  remainder…3

Who discovered electromagnetic induction?   **3**
Faraday   …3

As the handle is turned the bulb in the torch lights.
Explain why the bulb lights as the handle is turned.   **3×3**
turning handle moves magnet // turning handle moves coil //turning handle provided energy …3
relative to coil //relative to magnet   …3
emf induced // current flows   …3
[current carrying conductor in magnetic field experiences force …3]

What energy change occurs in a wind-up torch?   **5, 1**
kinetic energy /mechanical energy   …5
to electrical energy   …1

Name one other device based on the principle of electromagnetic induction.   **6**
alternator, generator, induction coil, induction hob, induction oven, transformer, etc any one…6

Question 6   **Answer any two parts**

(*a*)

The following terms are used in stating *Newton's law of universal gravitation*:
distance, square , product

        Using these terms, copy and complete the following statement of Newton's law of universal
        gravitation "The force between two masses is directly proportional to the . . . . .of the
        masses and inversely proportional to the . . . . of the . . . . between

        them."   **3×3**
        product   ...3
        square   ...3
        distance   ...3
        [in correct order]

Describe an experiment to measure the acceleration due to gravity, *g*.   **6×3**
        Apparatus: pendulum, string // electromagnet, ball //free fall of object   ...3
                             stand and cork or how suspended // stand, trapdoor // light gates   ...3
                               correct arrangement drawn or described   ...3

        Method: measure length // height / distance between light gates   ...3
                               time the oscillations // time fall of ball / record t_1 and t_2 ...3
                               g calculated from results / correct equation   ...3

Give one precaution to ensure an accurate result.   **6**
        repeat / use small angle / use long string / find average time for oscillation, etc   ...6

(*b*)

Figure 11 shows a wavefront of <u>monochromatic light</u> approaching a narrow gap.
        Explain the underlined term.   **6**
        one wavelength / one frequency / one colour   ...6

        Name a source of monochromatic light.   **6**
        sodium lamp, laser   ...6

Copy the diagram and show the path of the wavefront after passing through the gap.   **2×3**
        some light blocked   ...3
        diffraction or curvature at edges   ...3

Name the phenomenon which occurs at the gap.   **3**
        diffraction   ...3

This phenomenon can be used to measure the wavelength of monochromatic light..
Give two measurements which need to be taken during the experiment.   **9, 3**
        width of gap / distance to screen / angle of deflection of ray or distance between images
                                                                1st correct ..9
                                                             2nd correct ...3

(*c*)
State *Ohm's law*.   **3×3**
      (applied) emf or (applied) voltage / *V // V* 3
      proportional to / $\propto$ // =   ...3
      current at constant temperature // *I* // *IR* at constant temperature   ...3
      [omit at constant temperature (–1), omit to explain *I* and *V* (–1)]

Figure 12 shows an 8 Ω and a 12 Ω resistor connected in series with a battery.
The ammeter in the circuit gives a reading of 2.5 A.
Calculate: (i)   the voltage (potential difference) across the 12 Ω resistor   **3×3**
     $V = IR$ **...3**
     $V = 2.5 \times 12$ **...3**
     30 (V)   **...3**

(ii)   the effective resistance of the circuit   **2×3**
     $R = R_1 + R_2$ **...3**
     $R = 8 + 12 = 20 \ (\Omega)$ ...3

(iii)   the voltage across the battery.   **3**
     $V = IR \ = 2.5 \times 20 = 50 \ (V)$ ...3

The ammeter is now placed between the two resistors.
What does the ammeter read in this new position?   **6**
    2.5 A / the same   ...6

(*d*)
'Radioactivity is the spontaneous <u>disintegration</u> of unstable <u>nuclei</u> with the emission
of one or more types of nuclear radiation.'
Explain the underlined terms.   **3×3**
    decay /breaking up /splitting up   ...3
    centres of atoms   ...3
    where protons and neutrons are located   ...3

Figure 13 shows a beam from a radioactive sample passing between a pair of charged plates.
Name each one of the nuclear radiations, labelled X and Y.   **6, 3**
    gamma
    alpha
                              1st correct ...6
                              2nd correct ...3

Give the structure of Y.   **3×3**
    protons // helium   ...3
    neutrons // nucleus   ...3
    two of each   ...3
    or
    helium   ...6
    nucleus   ...3

List one use of radioactive substances.   **6**
    medical / cancer / carbon dating / detecting leaks / smoke detectors / produce energy /
    preserve foodstuffs, etc.   ...6

Question7   **Answer any eleven parts**

(*a*) **Figure 14 shows a sample of rock salt which contains the compound sodium chloride. What type of bonding exists in a crystal of sodium chloride?**
ionic   …6

(*b*) **Give one property of a proton.**
positively charged / charge +1 / located in nucleus / (relative) mass 1 / mass 1 amu   any one…6

(*c*) **Which subatomic particle is located in an *orbital*?**
electron   …6

(*d*) **In the equation $E = hf$, what does f represent?**
frequency   …6

(*e*) **Give one reason why the element fluorine has a large electronegativity value.**
small (atomic) radius / outer electrons close to nucleus
                                                                                    any one…6
[allow can accommodate an electron in outer shell   …6]
[define electronegativity …3]

(*f*) Calculate the percentage of carbon by mass in carbon monoxide (CO).
$M_r = 28$ …3
% carbon = $(12 \times 100) \div 28 = 42.86\%$ (42.86 – 43%)   …3

(*g*) **Give one property of a transition element.**
forms coloured compounds, is a good catalyst, has variable valency, has an incomplete *d*-subshell, has at least one ion with an incomplete *d*-subshell, metallic, a good conductor, etc
                                                                                    any one…6

(*h*) **What would you use to show that dissolving ammonium chloride in water is an endothermic process?**
thermometer / temperature drop   …6

(*i*) **Copy, complete and balance the following reaction: $CaCO_3 + HCl \rightarrow$ ___ + ___ + H_2O**
$2HCl$ / $CaCl_2$ / CO_2 any two …2 × 3

(*j*) **What is the pH of a 0.02 M solution of hydrochloric acid (HCl)?**
(pH =) $-\log_{10}[H^+]$ / $-\log[H^+]$ / $-\log[0.02]$
(pH =) 1.69 (1.69 – 1.7)

(*k*) **List the following metals in order of *increasing* activity: lead, sodium, silver.**
silver, lead, sodium / Ag, Pb, Na   …6
[one metal correct: sodium, lead, silver / silver, sodium, lead, / lead, silver sodium (–1)]
[reversed Na, Pb, Ag (–1)]]

(*l*) **What is an *electrolyte*?**
(electrically) conducting liquid   …6
[example …5]
[define electrolysis …3]

(**m**) **The relative molecular mass of oxygen gas (O$_2$) is 32.**
Calculate the number of molecules in 64 g of oxygen gas.
2 moles
$2 \times 6 \times 10^{23} = 1.2 \times 10^{24}$ 1st correct ..5
                                                                                    2nd correct …1

(**n**) **Give an example of an *alkane*.**
Methane, ethane, etc. Accept formula. Accept named cycloalkanes only but not formula.
                                                                                    any one… 6

(**o**) **What structural feature do aromatic compounds have in common?**
benzene (ring)   …6

Question 8

A <u>compound</u> of the <u>element</u> boron is used in the manufacture of laboratory glassware. Explain the underlined terms.   **4×3**
two or more elements   …3
joined chemically / bonded   …3
[example …3]
(substance that) cannot be made simpler / cannot be broken down //only one type   …3
chemically //of atom   …3
[example …3]

Define (i) *mass number*   **5, 1**
(number of) protons and neutrons   …5
in an atom   …1

(ii) *relative atomic mass*
mass of an atom   …3
average / compared to $1/12^{th}$ (mass of) carbon-12 (atom or isotope)   …3

Copy the following table and complete it by filling in the missing numbers: **6×3**

Atom	Atomic number	Mass number	Number of neutrons
$^{10}_{5}B$	**5**	**10**	**5**
$^{11}_{5}B$	**5**	**11**	**6**

….6×3

What name is given to a set of atoms such as $^{10}_{5}B$ and $^{11}_{5}B$?   **6**
isotopes   …6

A sample of boron consists of 20% $^{10}_{5}B$ and 80% $^{11}_{5}B$.
Calculate the relative atomic mass of this sample of boron.   **4×3**
$20 \times 10 = 200$ …3
$80 \times 11 = 880$ …3
$200 + 880 = 1080$ …3
$1080 \div 100 = 10.8(0)$ …3

Give the electronic (*s, p*) configuration of an atom of boron.   **6**
$1s^2\ 2s^2\ 2p^1$ / $1s^2\ 2s^2\ 2p_x^{\ 1}$ …6
or
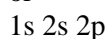1s 2s 2p   …3
correct assignment of the 5 electrons   …3
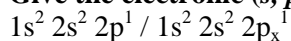
Question 9

(*a*)
Using the Brønsted-Lowry theory, define (i) an acid   **2×3**
proton   …3
donor   …3
[produces H^+ …5]

define (ii) a base   **2×3**
proton   …3
acceptor
[produces OH^- …5]   …3

Weak acids only slightly dissociate in solution. Give one example of a weak acid.   **6**
phosphoric, ethanoic acid, acetic acid, vinegar, benzoic acid, etc. Accept name or correct
formula. Accept tea, milk and other weak acid solutions.   any one   6
[sulfuric, hydrochloric or nitric acid …3]

Identify one acid and one base in the following reaction: $\mathbf{HF \ + \ H_2O \rightleftharpoons \ F^- \ + \ H_3O^+}$
                                                                                              6, 3
HF / H_3O^+ …6
H_2O / F^- …3

Give one example of a conjugate acid-base pair in the above reaction.   **6**
HF and F^-/ H_2O and H_3O^+ …6

(*b*)
Each one of the following elements reacts with hydrogen gas: nitrogen, sulfur, chlorine.
Give the name and chemical formula of the product formed in each reaction.   **5, 2×2, 3×1**
ammonia
NH_3
hydrogen sulphide
H_2S
hydrogen chloride [allow hydrochoric acid]
HCl

                    correct names or formulae for three substances…5, 2 × 2
                                    remaining names or formulae …3 × 1

From these products, identify (i) an acidic product   **6**
hydrogen sulphide / H_2S / hydrogen chloride / HCl …6
(ii) a basic product   **3**
ammonia / NH_3 …3

For one of these products: (iii) state its molecular shape   **6**
ammonia pyramidal / hydrogen sulphide v-shaped or planar / hydrogen chloride linear   …6

(iv) sketch its shape, showing the position of the atoms.   **6**
correct diagram   …6

Question 10

A student carried out a titration to <u>standardise</u> a <u>solution</u> of sodium hydroxide (NaOH).
Explain the underlined terms.   **6, 2×3**
find concentration   ...6
mixture / solid / liquid / gas //solute   ...3
dissolved in liquid //and solvent   ...3

Figure 15 shows some equipment which the student used.

(i) Name the glassware labelled A and B.
                                                                                                     2×6
A: burette   ...6
B: pipette   ...6
[reversed 2 ×3]

(ii) What is the purpose of C?   **6**
vessel for reaction to take place in / contains spatters   any one...6
[conical flask ...5]

(iii) Describe how glassware B is prepared and used to give a 20 cm^3 portion of
the sodium hydroxide solution.   **6, 3**
rinse with deionised water, rinse with solution it will contain / sodium hydroxide solution,
fill to mark, do not blow out last drop, use pipette filler, etc   1st correct ..6
                                                                                      2nd correct ...3

(iv) Name a suitable indicator for this titration.   **6**
phenolphthalein, methyl orange, litmus, etc   any one ...6
[universal indicator ...3]

(v) Give two safety precautions that the student should have followed while carrying out this
titration.   **2×6**
wear safety glasses, tie back hair, wear lab coat, wear gloves, avoid contact with corrosive liquids,
use pipette filler, etc   any two ...2 × 6
[non safety precaution,   any two... 2 × 3]

(vi) The student recorded that 20 cm^3 of sodium hydroxide (NaOH) solution was neutralised
by 18.7 cm^3 of 1.5 M hydrochloric acid (HCl) solution.
The chemical equation for this titration is: HCl   +   NaOH   →   NaCl   +   H$_2$O
Calculate the molarity of the sodium hydroxide solution.   **3×3**
$\dfrac{V_1 M_1}{n_1} / \dfrac{18.7 \times 1.5}{1} / 28.05$ ...3

$\dfrac{V_2 M_2}{n_2} / \dfrac{20 \times M_2}{1} / 20M_2$ ...3
$28.05 \div 20 = 1.4(025)$ ...3

Question 11

Ethanol (C_2H_5OH) can be produced by the <u>hydration</u> of ethene (C_2H_4).
What is meant by the underlined term?   **2×3**
addition of   …3
water   …3

Sketch the structural formula of (i) ethanol   **6**
CH_3CH_2OH …6

(ii) ethene   **6**
$CH_2 = CH_2$ …6

Name the *homologous series* to which ethanol belongs.   **6**
alcohols   …6

What is the name of the first member of this homologous series?   **3**
methanol   …3

Explain why ethene is an *unsaturated* compound.   **5, 1**
double bond   …5
between carbon atoms   …1

Describe the physical appearance, at room temperature, of (iii) ethanol,   **2×3**
colourless   …3
liquid   …3

(iv) sodium   **2×3**
grey / off-white /shiny / metallic   …3
solid   …3

Ethanol reacts with sodium according to the following chemical equation:
$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$ $\Delta H = -270 \text{ kJ mol}^{-1}$

How would you show that the gas produced in the above reaction is hydrogen?   **3, 6**
test with lighted taper   …3
burns with a pop   …6

Calculate:(v) the quantity of energy released when 1 mole of ethanol reacts with
1 mole of sodium   **2×3**
$270 \div 2$ …3
$= 135 \text{ (kJ mol}^{-1})$ …3

(vi) the number of moles of hydrogen released when 4 moles of ethanol and
4 moles of sodium react.   **6**
2   ….6

Question 12   **Answer any two parts.**

(*a*)

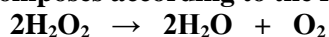**Define a *mole* of a substance.**   **2×3**
      Avogadro number // molecular mass // same number of particles // amount   …3
      of particles // in grams // as 12 g of carbon // of a chemical   …3

Hydrogen peroxide decomposes according to the following chemical equation:
$$2H_2O_2 \rightarrow 2H_2O + O_2$$
How could you make the hydrogen peroxide decompose faster?   **6**
      apply heat, increase temperature, add catalyst, use more concentrated hydrogen peroxide
                                                                 any one …6

Describe a test to confirm that the gas produced is oxygen.   **6, 3**
      re-ignites   …6
      glowing taper   …3

If 17 g of hydrogen peroxide were used in this reaction, calculate:
    (i)   the number of moles of hydrogen peroxide used   **2×3**
    $M_r = 34$ …3
    $17 \div 34 = 0.5$ (moles)   …3

    (ii) the mass of water produced.   **2×3**
    0.5 moles water   …3
    $0.5 \times 18 = 9$ (g)   …3

(*b*)

Figure 16 shows sulfur dioxide (SO_2) gas being prepared.
    (i)   Name the liquid A and the solid B.   **6, 3**
    sulfuric acid / H_2SO_4
    sodium sulfite / Na_2SO_3
                                                    1st correct …6
                                                  2nd correct …3

    (ii) What is the purpose of liquid C?   **6**
    to dry the gas   …6
    [allow purify gas …6]

    (iii) Describe the colour change observed as a sample of litmus solution is added
    to a gas jar full of sulfur dioxide.   **2×3**
    blue to   …3
    red   …3
    [colours reversed …3]

    (iv) State one physical property of sulfur dioxide.   **6**
    colourless, smelly, heavier than air, soluble in water   any one …6
    [poisonous, acidic, choking …5]

    (v)   Give one use of sulfur dioxide.   **6**
    used to make sulfur trioxide or sulfuric acid, canning, food preservative, bleaching,
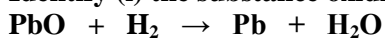   any one …6

(*c*)

Oxidation and **reduction** reactions occur in a car battery.
Define the underlined words in terms of electron transfer.   **4×3**

     loss   ...3
     of electrons   ...3
     gain   ...3
     of electrons   ...3

Identify (i) the substance oxidised, (ii) the substance reduced, in the following reaction:
PbO + H$_2$ → Pb + H$_2$O   **6, 3**

     hydrogen / H$_2$ ...6
     lead oxide /PbO   ...3

A clean iron nail is placed in a beaker containing a solution of copper sulfate.
Describe how the colour of the solution in the beaker changes.   **2×3**

     blue   ...3
     fades /goes colourless / brown (solid) appears   ...3

Copy and complete the following reaction which occurs in the beaker:
            Fe + CuSO$_4$ → _____ + _____   **2×3**

     FeSO$_4$ ...3
     Cu   ...3