1. (i) Purines pair with pyrimidines / adenine and thymine always pair as do cytosine and guanine;

Number of A = T/C = G;

(different organisms have) different base sequences;
different amount of each base pairing;   3

(ii) Presence of non-coding DNA/introns /junk / nonsense;   1

[4]

2. (a) (i) Purines pair with pyrimidines;
A pairs with T;
C pairs with G;   max 2

(ii) G = 26   T = 24   C = 26
A = T   C = G   3

(iii) Sequence of bases is important;   1

(b) (i) A does not equal T   C does not equal G;   1

(ii) DNA is not double stranded;   1

[8]

3. (a) **X** = Phosphate;   **I** Phosphoric acid   **R** additional wrong chemical
Y = Pentose / Deoxyribose;   2

(b) (i) 21   29

17   17 ;   1

(ii) DNA is double stranded;
Pairing of bases / **A** pairs with **T** / **C** pairs with **G**;
(**I** reference to bases being same as or equal to each other)
Evidence of calculation of octopus figures;   max 2

[5]

4. (a) Anaphase I;
Chromo<u>somes</u> / chromatid pairs / bivalents are separating;
Allow: "they" are separating   2

(b) 8;   1

(c) 2;   1

(c) So fertilisation / described can restore (diploid) number / prevent
     chromosome doubling at fertilisation / described;
     Ignore references to "variation"   1

                                                                              [5]

5. (a) P = cytosine
             Q = deoxyribose / 5C sugar / pentose
             R = phosphate / phosphoric acid
                   3 right = 2 marks
                   2 right = 1 mark
                   <2 right = 0 marks   2

     (b) DNA strand separates / H-bonds break; *accept 'unzips'*
          New molecules formed have one 'old' <u>strand</u> and one 'new' <u>strand</u>;   2

     (c) 15% cytosine, therefore 70% adenine and thymine
          70% / 2 = 35%
          Correct answer of 35% gains 2 marks.
          Incorrect answer clearly showing that C + G = A + T gains 1 mark   2

                                                                              [6]

6. (a) (i) **A** / identified (e.g. 7):
                  has ½ mass of DNA in B / ¼ mass of DNA in C / would have ½
                  chromosome number of B / contains least DNA / has 23
                  chromosomes;
                  Reject haploid   1

          (ii) 14 (arbitrary units);
                Diploid number of chromosomes re-established;
                Gametes are haploid (*or concept explained*) / each gamete will
                contain 7 units;   2 max

     (b) Separation of chromatid pairs / chromatids within a pair / chromosomes;
          Reject 'homologous chromosomes'   1

                                                                              [4]

7. (a) Identify those at risk from <u>developing</u> cancer;
             So as to avoid relevant environmental factors / enable early diagnosis;
             Identify risk in families;   2 max

(b) *Mutation of suppressor gene – up to 4 marks*

1. Mutation is a change in the DNA / sense strand;
2. Base sequence altered / e.g.;
3. Suppressor gene produces wrong instructions / has different code;
4. (Therefore) different amino acid sequence;
5. Different protein structure / non-functional protein;

Malignant tumour – up to 2 marks

6. Cell division by mitosis;
7. Tumour cells growth abnormal / continuous / uncontrolled / rapid;
8. Tumour cells spread / invade other tissues / form secondary tumours / metastasis;
9. Via blood / lymph system;   6 max

(c) (i) Most lung cancer occurs in smokers / non-smokers also develop lung cancer;
Smoking increases the risk of lung cancer;
Smoking is an environmental factor for lung cancer;
Smokers' risk more than 4x that of non-smokers / correct ref to figures;
(But) only a small proportion of smokers develop lung cancer;
Smokers more likely to develop other lung disease than cancer;   3 max

(ii) Do not know size of sample / might be small sample in study;
Genetic differences / predisposition;
Could be different age at which started to smoke;
Could be different number of cigarettes smoked per day;
Could be different tar levels in cigarettes smoked;
Could be different sexes in sample;
Other valid;   2 max

(d) All exposed to same environmental conditions / factors / no regional variations;
Same level of pollution / example; reject *less pollution*
Similar diet / example;
Same water supply;
Easier to screen whole population;
Easier to follow family history / people related;
Identify genetic differences in those affected (since everything else the same) / less genetic diversity;   2 max

[15]

8. (a) (i) Correct sequence:
1. Interphase
2. Prophase
3. Metaphase
4. Anaphase
5. Telophase;   1

    (ii) 1nterphase;   1

(b) <u>Drawing</u>: Two chromatids joined by centromere;[If > *I picture drawn, allow if all correct]*
Chromatids <u>attached </u>to spindle fibre by centromere;

    <u>Labels</u>: Centromere + chromatid + spindle fibre correctly labelled;   3

(c) (i) 8 (*)

    (ii) 4 (*)   1

       (*) both correct

[6]

9. (a) (i) B;   1

    (ii) C;   1

(b) Amount of DNA halved,
(At start of mitosis) DNA has replicated;
Chromatids/ chromosomes separate;
At anaphase;
Role of spindle;   max 3

(c) (i) Stage B would take longer/ would not occur/
graph would be flat/ not so steep;   1

    (ii) No DNA synthesis so cells don't divide/ reduced DNA synthesis so
cells divide more slowly/ cytarabine inhibits cell division;
Stops/ slows formation of new cancer cells/ stops/
reduces spread of cancer: 2

[8]

10. (i)   sugar or phosphate / S-P / nucleotide chain/backbone /
        original/parent DNA;   1

      (ii)   X thymine; Y guanine; Z adenine;
           (*Allow T, G and A*) *Reject: thiamine*   3

                                                                [4]

11. (a)   Chromosomes attach to equator/middle of cell/spindle;
           Prophase;
           Anaphase;
           DNA replication/synthesis / chromosome copying/duplication;
           Telophase;   5

      (b)   (i)   Meiosis;   1

                (ii)   32;   1

                                                                [7]

12. (a)   nucleotide;   1

      (b)   (i)   21.4, 21.4; 28.6;   2

                (ii)   amounts of A and T /C and G/complementary bases different;
                       therefore no base-pairing;   2 max

                                                                 [5]

13. (a)   antibiotic has diffused/spread/moved into agar;
           killed/inhibited bacteria;   2

      (b)   largest clear area/inhibition zone/killed the most bacteria;   1

      (c)   disrupts cell wall/prevents cell wall synthesis;
           stops DNA replication;   2

                                                                 [5]

14. (a) Chromosomes: $C = 8$ *and* $D = 4$;
DNA: $C = 300$ *and* $D = 150$; 2

(b) (i) testis / ovary; 1
accept anther / carpel / stamen / testicle

(ii) to make chromosomes / chromatids / DNA / genetic material visible; 1

[4]

15. (a) (i) base / named bases; 1
reject nucleotide or uracil

(ii) it has been produced by semi-conservative replication / one old strand
and one new; one strand has ^{15}N bases and the other ^{14}N;
Accept light/ heavy N
(therefore) it is less dense / lighter; 2 max

(iii) one band is in same position as generation 1;
one band higher;
accept a line. N.B. need a visible gap 2

(b) (i) A = 31 and JT = 31;
C = 19; 2

(ii) viral DNA single-stranded / not double-stranded;
evidence from table e.g. not equal amount of A and T
/ C and G / all different; 2
ignore no base-pairing In this **Question** *assume
It' means viral DNA*

[9]

16. (a) Diagram showing two identical molecules;
Each with one original and one new strand; 2

(b) (i) 7.31 – 7.36;
Same as liver cell/blood cell/twice sperm cell; 2

(ii) 5.78;
Sperm cell + egg cell, both with 2.89/twice sperm cell; 2

[6]

17. (a) Phosphate;

Deoxyribose; 2

> **Q** *Candidates must specify deoxyribose. This term is a
> specification requirement.
> Ignore anything that is not incorrect.*

    (b)   4;   1

    (c)   (i)   14;   1

            (ii)   36;   1

                  If (c)(i) incorrect accept [50 – (c)(i)]

    (d)   Different proteins;

            Different genes;

            Different (DNA) base sequences;   2 max

[7]