

Classification & Identification questions

1. What compatibility group do fireworks belong to? **G** – from ADR 2.2.1.1.6 or from the default Fireworks classification table 2.2.1.1.7.5 or from the dangerous goods list entries for fireworks
2. Can carbonyl fluoride be shipped as a compressed gas? **No** – look up Table B to get the UN number, then look up the UN number and see that the only classification code is 2TC – then look up the meaning of 2 in ADR 2.2.2.1.2 which is for a liquefied gas
3. Explain the meaning of the classification code 1.1A? **A primary explosive substance with a mass explosion hazard** – see ADR 2.2.1.1.5 & 2.2.1.1.6
4. An organic powder displayed a burning rate of 2.5 mm/sec in tests performed according to the UN Manual of Tests and criteria and was retarded by the wetted zone for 3.6 minutes. What is the appropriate class and packing group? **Class 4.1, PG II** – ADR 2.2.41.1.5(a) & 2.2.41.1.8(a)
5. Can krypton be shipped as a liquefied gas? **No** – there are two entries for Krypton, one for the compressed gas and one for the refrigerated liquefied gas, but there is no classification code corresponding to a straight liquefied gas – ADR Table B
6. What explosive division does a firecracker belong to? **1.4** – look it up in the default Fireworks classification table - ADR 2.2.1.1.7.5
7. How many hazard groups exist for aerosols? **12** – ADR 2.2.2.1.6
8. What criteria are used to decide whether a flammable liquid should be placed in Packing Group II or III? **Flashpoint (Table in ADR 2.2.3.1.3) and viscosity (ADR 2.2.3.1.4) - boiling point only matters for deciding if PG I applies**
9. What is the definition of flammable solids according to the ADR? **Flammable solids are readily combustible solids and solids which may cause fire through friction.** – ADR 2.2.41.1.3
10. What does the S signify when shown on an explosives label? **That the substance is so packed or designed that any hazardous effects arising from accidental functioning are confined within the package** – ADR 2.2.1.1.6
11. What is the definition of a gas? **A gas is a substance which: (a) at 50 °C has a vapour pressure greater than 300 kPa (3 bar); or(b) is completely gaseous at 20 °C at the standard pressure of 101.3 kPa.** ADR 2.2.2.1.1
12. The flame took 11 minutes to spread over the whole length of the sample when a new metal alloy was tested according to the UN manual of tests and criteria. Will this material be subject to transport regulations? **No, does not meet the criteria for metal alloy flammable solids** – ADR 2.2.41.1.5(b)
13. What packing method can be used with Peroxylauric acid? **OP 8** – it is an organic peroxide listed in table 2.2.52.4 – Peroxy in the name was the only hint as to its oxidizing properties and when you could not find it in Table B to then look in the list of organic peroxides
14. What is the definition of an organic peroxide? **Organic peroxides are organic substances which contain the bivalent -O-O- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals.** – ADR 2.2.52.1.1
15. Define infectious genetically modified microorganisms? **Microorganisms which can cause disease in humans or animals and in which genetic material has been purposely altered**

through genetic engineering in a way that does not occur naturally. – you have to combine the definition of infectious substance in ADR 2.2.62.1.1 and GMOs in 2.2.9.1.11

16. What is the class, classification code, UN number and packing group of turpentine substitute? Can it be shipped under the proper shipping name “paint related material”?
Class 3, F1, UN1300 PG II or III. No - special provision 163 shown against UN 1263 for paint related material (the only entry with the same classification code) states that this entry can not be used for a substance that has its own specific entry which turpentine substitute has – ADR Table B, Table A, 3.3

17. Exercise (Typical exam type questions)

Determine the class and subsidiary risk (if applicable) of the following

(a) A liquid with

Flash point 15 °C Boiling point 45 °C = Class 3 PG II

LD₅₀ oral 4.5 mg/kg = Class 6.1 PG I

Skin destruction after 90 min exposure and an observation time of 3 days = Class 8 PGIII

Use of the Table of precedence gives the result Class 3 with subsidiary risks Corrosive and Toxic

(b) A pesticide solution

Flashpoint 50 °C = Class 3 PG III

LD₅₀ oral 200 mg/kg = Class 6.1 PG III

Use of the table of precedence gives the result Class 6.1 with flammable subsidiary risk when it is a pesticide – the “a” note reverses the primary hazard at the intersection that would normally apply.

18. Challenge exercise (unlikely in an exam)

A new liquid substance had the following properties

Flash point = 58 °C = Class 3 PG III

Saturated vapour concentration at 20 °C = 800 ml/m³

LD₅₀ (oral, rats) = 10 mg/kg = Class 6.1 PG II

LD₅₀ (dermal, rabbits) = 45 mg/kg = Class 6.1 PG I

LC₅₀ (rats, 1 hour inhalation) = 4,500 ml/m³ not toxic by inhalation as saturated vapour < 1/5 LC₅₀ value when the value is between 3000 and 5000 ml/m³

LC₅₀ (rainbow trout) = 0.05 mg/l = EHS Acute 1

EC₅₀ (Daphnia) = 0.25 mg/l = EHS Acute 1

ErC₅₀ (Algae) = 1.2 mg/l - not indicative of EHS – above threshold

Classify the substance

Using the table of precedence we get Class 6.1, PG I with subsidiary risk Flammable. The substance would also be environmentally hazardous and may require the application of the EHS mark depending on the package size, but it is not a class 9 subsidiary risk

The substance is sold as a product at a concentration of 3% in water. Is this product dangerous for transport and if so what class does it belong to?

The mixture will not be flammable as it is predominantly water and will not support burning. – Note 1 2.2.3.1.1

The calculated oral toxicities is $10 \times 100/3 = 333$ mg/kg and dermal = $45 \times 100/3 = 1,500$ mg/l – ADR 2.2.61.1.10.1 formula - so it does not meet class 6.1 criteria

It is still an EHS as $3 \times 10 = 30 > 25\%$ - Tables 2.2.9.1.10.4.6.2.2 & 2.2.9.1.10.4.6.4

Thus it is class 9

19. Exercises

Classify & select an appropriate proper shipping name for the following preparations

60% sodium azide [LD₅₀ (O) 27 mg/kg]: 40% sodium chloride?

LD₅₀ mixture = $27 \times 100/60 = 45$ mg/kg. Thus Class 6.1 PG II

Pure sodium azide is a named toxic inorganic solid PGII and as the class, PG and form are the same for this mixture SODIUM AZIDE MIXTURE is the correct PSN

50% sodium azide [LD₅₀ (O) 27 mg/kg]: 50% sodium chloride?

LD₅₀ mixture = $27 \times 100/50 = 54$ mg/kg. This is also Class 6.1 but it is now PG III. Thus a collective entry is required TOXIC SOLID, INORGANIC N.O.S. (Contains sodium azide) as SP274 applies

60% sodium azide [LD₅₀ (O) 27 mg/kg] in water?

LD₅₀ mixture = $27 \times 100/60 = 45$ mg/kg Thus Class 6.1 PG II

But there is a change of form from solid to a liquid. Thus another collective entry is required TOXIC LIQUID, INORGANIC N.O.S. (Contains sodium azide) as SP274 applies

75% resorcinol [LD₅₀ (O) 200 mg/kg] in a non-flammable, non-toxic solvent?

Resorcinol is another named substance which from its classification code can be deduced to be an organic solid

LD₅₀ mixture = $200 \times 100/75 = 266$ mg/kg. Thus Class 6.1 PG III. But there is a change of form from solid to a liquid. Thus another collective entry is required Toxic liquid, organic N.O.S. (contains resorcinol)

50% resorcinol in the same solvent?

LD₅₀ mixture = $200 \times 100/50 = 400$. Thus not subject to ADR and so no class or PSN applies

20. A standard Formalin product contains 37% formaldehyde with 10 – 15 % methanol as stabilizer. The flash point is 62C. Select an appropriate UN number proper shipping name and class? A 10%Formalin solution is prepared in the lab by diluting the stock 1/10 with water. After use the 10% Formalin solution must be removed by a waste contractor. Is this subject to ADR transport regulations?

Formalin is not specifically listed in the DGL but in the alphabetical list there is reference to two entries that could be used UN 1198 for FORMALDEHYDE SOLUTION, FLAMMABLE and UN 2209 for FORMALDEHYDE SOLUTION that is corrosive only As the solution is not flammable (FP >60C) UN 2209 FORMALDEHYDE SOLUTION is the correct choice.

The 10% formalin (3.7% formaldehyde is not subject to ADR according to special provision 533 which states that non-flammable solutions with <25% formaldehyde are exempt.

- 21 . An R&D chemist is working on a new solution for electropolishing metallic surfaces, which he wishes to ship to a metal fabricator for testing. It consists of 8% sulphuric acid and 92% ethanol. When tested, the mixture had a flashpoint of 45°C. Classify the mixture and select an appropriate UN number and proper shipping name.

A flashpoint of 45°C meets the criteria of Class 3 PG III

Sulphuric acid is listed in Table B as a Class 8 material with various UN numbers. UN 2796 is for solutions with less than 51% that is assigned to PG II.

To confirm that Class 8 PG II should also apply to an 8% solution, use the calculation method in Figure 2.8.1.6.3. As there is greater than 5% of a PG II material, the mixture also satisfies Class 8 PG II criteria.

Based on the table of precedence the mixture classifies as Class 8 PG II, with a subsidiary Class 3 hazard

The UN Number and proper shipping name should be UN 2920 CORROSIVE LIQUID, FLAMMABLE, N.O.S. (Ethanol, Sulphuric acid)

22. When tested, an acidic inorganic solid caused full destruction of healthy skin after 2 minutes exposure and had an estimated LD₅₀ oral of 4 mg/kg .

a) Classify the substance

Skin destruction within 3 minutes = Class 8 PG I

Acute oral toxicity less than 5 mg/kg = Class 6.1 PG I

Table of precedence gives Class 6.1 with a subsidiary hazard 8, PG I

b) Select a suitable UN number and proper shipping name for the substance. The technical name is allulox.

UN 3290 TOXIC SOLID, CORROSIVE, INORGANIC, N.O.S. (Allulox)

The substance is also shipped as a 1% solution in water. Identify a suitable UN number and proper shipping name for the solution

According to flowchart for classification of mixtures in 2.2.8.1.6.3 it satisfies the criteria for Class 8 PG II

According to formula in 2.2.61.1.10.1 the LD50 of the mixture = $4 \times 100 / 1 = 400$ mg/kg which is not toxic.

Thus UN3264 CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (Contains Allulox)

Ref ADR 2.2.8.1.5.3, 2.2.61.1.7, 2.1.3.10, Table A, 3.3 SP274, 3.1.2.8, 2.2.8.1.6.3, 2.2.61.1.10.1,